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Carbon and the Properties of Cast Iron

The Difference in the Properties of Cast Iron Shown to Be Due to the Distribution of Its Carbon between the Graphitic and Combined States

BY HENRY M. HOWE*

The object of the present paper is to explain in simple terms how it comes about that the remarkable difference between the properties of different kinds of cast iron are due chiefly to the distribution of its carbon between the graphitic and the combined states. Cast iron may, indeed, be said to be rather a class or group of different substances than a single substance. The hard, brittle, white cast iron of chilled stamp shoes, of the tread of car wheels, and of crusher jaws, has little in common with the soft, impact-resisting gray iron of machinery castings, save that both are fusible, and both rich in carbon. In most of their properties they are strikingly unlike. The great differences between them are due essentially to the fact that in the white iron the carbon is nearly all combined, whereas in the gray it is nearly all in the state of graphite.[1]

The matter is really extremely simple, if we will only take the pains to set up a few clear mental pictures.

First, let us conceive of gray cast iron as really composed of two wholly distinct substances, fine sheetlets of graphite, wholly nonmetallic, weak, and soft, which, as a skeleton, are incased within a matrix which is the truly metallic part of the cast iron, somewhat as sand is incased in concrete. This conception of metallic matrix and the skeleton of graphite inclosed within it is essential to a clear understanding of the subject.

The next conception to be grasped is that the combined carbon is combined with this metallic matrix, and that it influences the properties of the matrix in exactly the way in which the properties of steel are influenced by its carbon content. Let us, therefore, refresh our memory as to the reason for this influence of carbon on steel. To understand this we must regard steel as a mixture or conglomerate or concrete of the two wholly distinct substances, pure iron, or as it is often called "ferrite," which is like copper in most respects except color and magnetism, and the extremely hard, brittle iron carbide called cementite, Fe_3C. If we leave out of account the hardened steel of tools, springs, etc., then all the carbon of our common steel exists in the form of this intensely hard and brittle cementite, in fine microscopic particles.

The reason why the properties of steel change as its carbon content increases is that this increase implies the increase of the proportion of this glass-hard cementite which the metal contains. In the dead-soft steel used for lap-welded tubing and for cold-driven rivets, there is as little carbon as practicable, say, 0.06 per cent., and as a consequence the metal consists almost solely of the extremely soft, ductile ferrite. As the carbon content increases, the proportion of this cementite increases at the rate of 1.50 per cent. for each 0.10 per cent. of carbon. Rail steel of, say, 0.50 per cent. of carbon is much harder than rivet steel, essentially because the presence of this 0.5 per cent. of carbon implies the presence of 7.5 per cent. of this hard, brittle cementite. Die steel of 2 per cent. of carbon is still harder, because it contains no less than 30 per cent. of this cementite, mechanically mixed with 70 per cent. of ferrite.

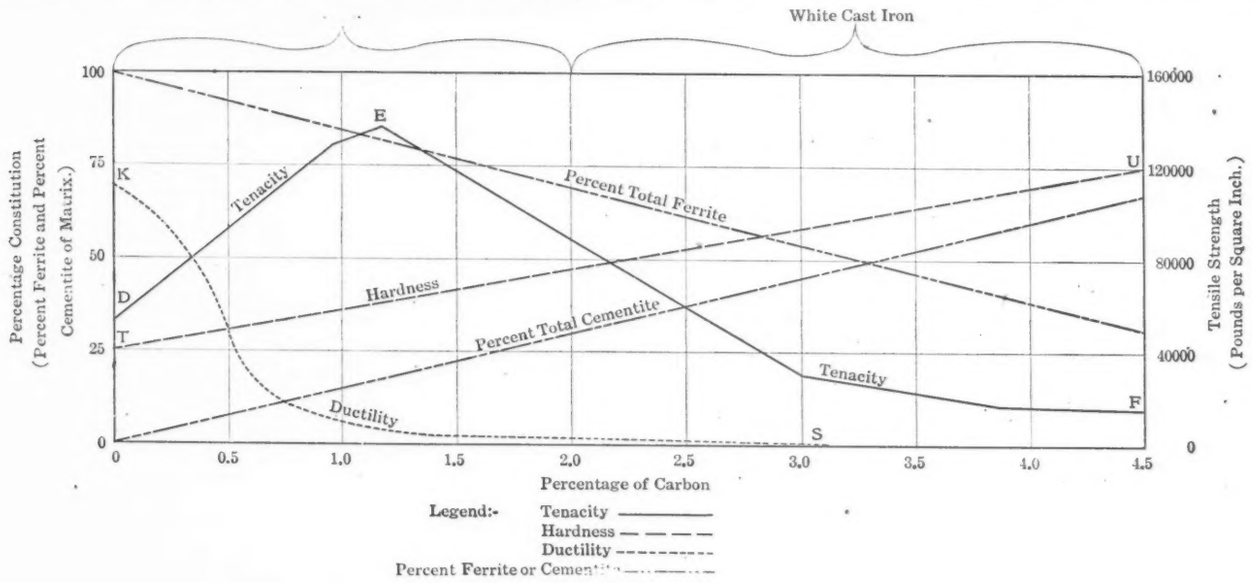

FIG. I

Division Line between Steel and Cast Iron

The properties of such a series of steels are represented roughly in Fig. 1, together with the proportions of the ferrite and the cementite present, which are the causes of those properties. This diagram includes with steel white cast iron, for a

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[1]The explanation here offered of the influence of the condition of carbon on hardness, strength and ductility, has been given in my previous writings. I add to it here a like explanation of the influence of the carbon-condition on porosity and on expansion in solidifying, and give concrete examples.

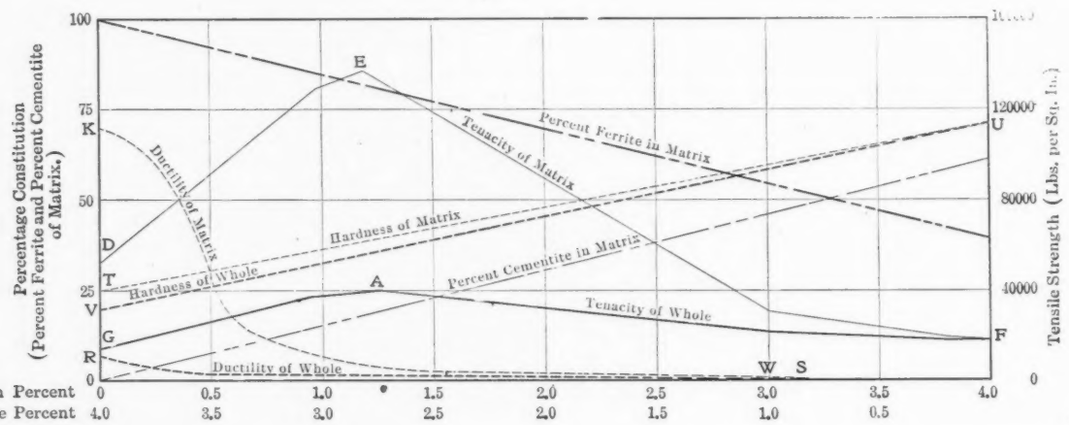
simple reason. When the proportion of combined carbon rises above about 2.2 per cent., the metal is no longer called steel, but white cast iron, though there is an ill-defined intermediate part which is often spoken of as semi-steel. But it is evident that the series of white cast irons containing from 2.2 per cent. to, say, 4 per cent. of combined carbon and no graphite, is nothing whatsoever but a prolongation of the series of steels containing combined carbon all the way from zero to 2.2 per cent. The two series are in fact a single unbroken series, to the two divisions of which different names

Hardening Effect of Inclosed Cementite

That the metal should grow progressively harder and harder (*T U*, Fig. 1), and less and less ductile (*K S*) as the carbon content increases, and as with the carbon content the proportion of this hard and brittle cementite increases, is, of course, perfectly natural. The influence of the carbon content on the tensile strength though somewhat less simple, is still readily understood. As the carbon content increases from zero up to about 1.25 per cent. (*D E*), the tensile strength increases pretty regularly, which is but pull its ends apart, or in short lessening the tensile strength of the putty. We can readily understand that it should be true that, whereas a slight admixture of mica might strengthen the putty by resisting its tendency to flow, yet a larger quantity should weaken it because the degree to which it would break up the continuity of the putty would outweigh its strengthening effect due to its opposing the tendency to flow. In short, it is easy to understand that a little mica should strengthen the putty, but that much should weaken it.

In the same way it is easy to under-

Name of matrix	Low carbon steel	Medium carbon steel	High carbon steel	White cast iron	
Name of the cast iron *i.e.*, of the whole	Very open gray or very graphitic cast iron		Close gray cast iron	Mottled cast iron	White cast iron



	Strength		Weak	Strongest		Weak
	Ductility		Least brittle			Most brittle
	Hardness		Softest	Soft	Harder	Hardest
Because of its	strength and ductility	the iron is suited to uses in which it will have to undergo or resist	shock	moderate shock, the iron suited to most engineering purposes		no shock unless metal is strongly supported
	hardness		much machining in preparation, but little abrasion in use	moderate machining in preparation, not excessive abrasion in use		no machining in preparation, much abrasion in use

FIG. 2

are assigned, just as Ninth avenue in New York changes abruptly into Columbus avenue at an imaginary line at Fifty-ninth street, but without change of direction, shape, size, or quality; and as, legally speaking, the minor changes abruptly into the major at the stroke of the midnight clock which ushers in his 21st birthday.

With this diagram before us, we get a rational explanation of the way in which the properties of this series, steel—white cast iron, change as the carbon content increases progressively from zero to, say, 4 per cent.

natural. But with farther increase of carbon content the strength in turn decreases (*E F*). The tendency of the soft, pliable, copper-like pure iron or ferrite is to flow under tensile stress, as a bar of putty would flow or draw out if its ends are pulled apart. If we mix sheets of mica in with the putty, we can readily understand that this mica should oppose the flowing of the putty under our pull, and so should strengthen it. But this mica has simultaneously another and opposite effect, that of breaking up continuity, and thereby lessening the power of our bar of putty to resist our attempt to

stand that a moderate quantity of microscopic sheets of cementite should strengthen steel by opposing its tendency to flow under tensile stress, yet that a larger proportion should in turn weaken it by breaking up the continuity of the mass of ferrite in which it is imbedded. We could not, indeed, prophesy beforehand that the carbon content at which the strengthening effect begins to be outweighed by the weakening effect should be 1.25 per cent., i.e., that this is the carbon content which gives the greatest tensile strength. But when we learn that this is the case, it need not surprise us. We

can understand that it should be true, which is the main thing.

Now let us try to apply this conception to the case of cast iron, to see how we may explain by it the changes in the properties which take place as the carbon changes from the graphitic to the combined state. Let us recognize that graphite-bearing cast iron is a conglomerate in the second degree, consisting of a skeleton of graphite incased in a metallic matrix, which itself is a conglomerate of ferrite and cementite. We have, therefore, to consider the changes, first in the quantity of the graphitic skeleton, and second in the properties of the incasing metallic or steel matrix.

Changes in the Properties of Cast Iron

To fix our ideas let us conceive a series of cast irons all with the same total carbon content, say 4 per cent. Let us assume at one end of our series an ultra gray cast iron with its carbon all in the state of graphite, and at the other end a pure white iron with its carbon all combined, i.e., in the state of cementite, of which it would, therefore, contain $4 \times 15 = 60$ per cent. As we pass from the gray cast-iron end of the series toward the other or white cast-iron end, there is a progressive transfer of the carbon from the graphitic to the combined state. The point for us to recognize here is that this transfer has two distinct aspects, first lessening the quantity of graphite present, second, increasing the carbon content of the metallic matrix in which that graphite is inclosed.

Let us take first ultra gray cast iron with no combined carbon at all, or better, only 0.06 per cent. of combined carbon. It is evidently a conglomerate which consists, first, of 3.94 per cent. of graphite, and, second, of a metallic matrix in which that graphite is incased. This matrix contains only this 0.06 per cent. of carbon, and is, therefore, nothing but iron containing $0.06 \times 15 = 0.90$ per cent. of cementite, and contaminated with whatever phosphorus, sulphur or silicon is present. It is, therefore, the equivalent of a dead soft, ultra low-carbon steel, rendered impure by these foreign elements. Recognize clearly that this matrix in its very nature is absolutely identical with such steel. It consists essentially of a mechanical mixture of much ferrite and very little cementite, usually impure indeed, but still such a mixture, and nothing more or less than such a mixture. Such steel consists of such a mixture, and thus the steel and the matrix of our cast iron are absolutely identical, except only for such differences in purity as may happen to exist between impure steels and impure cast irons.

Let us take as our next step a cast iron in which 0.25 per cent. of the carbon has passed from the graphitic to the combined state. Here there is still 3.75 per cent. of graphite, and the matrix, which contains this 0.25 per cent. of combined carbon, is essentially a boiler-plate steel, because slagless iron containing 0.25 per cent. of combined carbon is boiler-plate steel. This cast iron, then, differs from the first in two ways. First, it contains less graphite, and on this account should be stronger, because graphite, by breaking up the continuity of the mass as a whole, certainly ought to weaken it. Second, its matrix is stronger than that of our first cast iron, because it is a boiler-plate steel, which is notoriously stronger than dead soft rivet or skelp steel, or because it is notorious that steel is greatly strengthened by increasing its carbon content from 0.06 to 0.25 per cent.

Let us take as our next step a cast iron which contains 3.5 per cent. of graphite and 0.5 per cent. of combined carbon. This cast iron then is a conglomerate consisting first of 3.5 per cent. of graphite, and second of a metallic matrix containing about 0.50 per cent. of carbon. But this matrix is evidently equivalent to a rail steel, because iron containing 0.50 per cent. of combined carbon is rail steel. This cast iron then should be stronger than the preceding for two reasons which act cumulatively. First, it has less of the continuity-breaking graphite; second, its matrix is stronger, because it contains 0.50 per cent. of carbon instead of 0.25 per cent.

Weakening Effect of Graphite Skeleton

By like reasoning this two-fold strengthening of the cast iron as a whole by the decrease of the weakening graphite skeleton, and by the simultaneous strengthening of the steel which constitutes the metallic matrix, should continue till the carbon content of the steel matrix reaches 1.25 per cent., *D E*, of Fig. 1. The line *G A*, Fig. 2, is a first attempt to represent this strengthening. But when the transfer of carbon from the graphite skeleton to the steel matrix continues past this point, the strength of the matrix begins to decrease (*E F* of Fig. 1), so that now the strengthening effect of the decrease of graphite is resisted by the weakening effect of the increasing carbon content of the steel matrix.

Fig. 2 gives an attempt to show the effects of these simultaneous changes in the continuity of the skeleton and the properties of the matrix. *D E F*, reproduced from Fig. 1 gives the tensile strength of the matrix, and *G A F* sketches that of the cast iron as a whole, the gap between these two lines at any given vertical line representing the weakening effect of the graphitic skeleton. Now, as the combined carbon content increases progressively from 1.25 to 4 per cent., and as with it the graphite skeleton decreases from 2.75 per cent. of the whole mass to zero, we may conjecture that this decrease, by lessening the discontinuity of the mass, progressively lessens the gap between the tensile strength of the metallic matrix and that of the mass as a whole. In other words, if the reason why the cast iron as a whole is weaker than its own matrix, is that it is weakened by the graphitic skeleton, then the less of this skeleton there is the less should be this weakening effect, and the less should be the difference between the strength of matrix and that of cast iron as a whole.

The line *A F* thus sketched gives us only a first approximation to the truth, because, strictly speaking, the weakening effect of the graphite is not proportionate to its mass, but rather to the degree of continuity of the skeleton, which the graphite forms. Now, though the continuity of the skeleton decreases in a general way as the percentage of graphite decreases, yet it is not necessarily true that the two should decrease in one and the same proportion. Indeed, from *G* to *A* the gap increases as the percentage of graphite decreases. This is a matter of actual observation. We know that there is no such increase in the strength of cast iron as would be implied by making this gap decrease, as the graphite decreases from 4 to 2.75 per cent. A reason for this increase in the width of the gap from *G* to *A* is at hand in the well known fact that, as the carbon-content of steel increases from 0 to 1.25 per cent., with it increases the injury which any nick or flaw causes. The little holes in the steel matrix which the presence of these little sheets of graphite implies, naturally should weaken that matrix much in the same way as that in which any nick or dent does.

The two lines, of course, meet at *F*, which represents 4 per cent. white cast iron, the right-hand member of both series.

Hardness, Ductility and Porosity

The hardness of the left-hand member of the cast-iron series, the ultra gray cast iron with practically no combined carbon, should be a little less than that of the very low-carbon steel of which its matrix consists, because the graphite skeleton which it contains is itself softer than that steel. The gap *T V* between these lines at their beginning is intended to represent this difference in hardness, but only qualitatively. As, passing to the right, the quantity of the soft graphite decreases, this gap should diminish progressively, of course, becoming zero at the right-hand end of the series, because white cast iron with 4 per cent. of combined carbon and no graphite is common to both series.

In the same way the ductility of the left-hand member of the cast-iron series, the ultra gray cast iron, should be much less than that of the ultra low-carbon steel, *K*, of which its matrix consists, because of the lack of continuity which this

graphite skeleton causes. The gap between the ductility line *K S* of the matrix and that of the cast iron as a whole, *R S*, should decrease as, passing to the right, the quantity of graphite decreases, because the less graphite there is the less should it break up the continuity, and the less, therefore, should it decrease the ductility.

But we may go still farther. The presence and quantity of the graphite skeleton explain not only the variations in strength, hardness, and ductility of the various grades of cast iron as we have now seen, but also the variations in porosity and in the permanent expansion in solidifying. If the skeleton which the graphite forms is nearly continuous, then the junctions between it and the matrix within which it is inclosed form a path of low resistance, along which fluids under high pressure can pass. Hence, cast iron for radiators and for hydraulic cylinders, which should be gas-tight and water-tight, should have but little graphite, and we may believe that it ought to be cast under such conditions that its solidification should not be extremely slow, because the slower the freezing the more clearly continuous would the skeleton be.

The very act of birth of so bulky a substance as graphite within the solidifying cast iron naturally should make the metal expand suddenly and markedly as it solidifies, and so it does. The late experiments of Heyn and Bauer[2], and of Goerens and Gutowsky[3], show that this generation of graphite takes place at and immediately after the passage from the molten to the solid state. Hence, ornamental castings, and others which must needs reproduce the details of the mold faithfully, should contain much graphite, so that they may expand much in solidifying, and their passage from the molten to the solid state should not be hurried, so that the formation of graphite may have time to take place.

Means of Controlling the Distribution of the Carbon between its Two States, the Graphite Skeleton and the Cementite of the Matrix

This distribution is controlled chiefly by the percentage of silicon which the cast iron is given, because the presence of silicon favors the formation of graphite. But beyond this, rapid cooling, the presence of sulphur, and in most cases that of manganese, oppose the formation of graphite. Hence in thin and, therefore, rapidly cooling castings, and in those which contain more sulphur than usual, the silicon content should be higher than in thicker castings and in those which contain less sulphur. Thus there is usually between 1.50 and 2.25 per cent. of silicon in *thick machinery castings*, whereas there may be as much as 3 or even 3.40 per cent. of silicon in *thin castings*, and in *ornamental* ones, the metal for which must generate much graphite so that it may expand much in solidifying and thus may fill every crevice of the mold. *Steam radiators*, and the *cylinders of hydraulic presses*, a very important duty of which is to prevent their fluid contents from leaking through, should have but little graphite. Hence they may well contain as little as 1.75 per cent. of silicon, or even as 1 per cent. in case impenetrability is of such importance that, in order to get it, some sacrifice of softness and consequent ease of machining must be endured.

Cast-iron railroad car wheels must have an intensely hard rim or tread, in order to resist the abrasion of the brake-shoe and rail, but their bodies must not be brittle, lest they break under the great shocks to which these heavily loaded wheels are exposed. Hence cast iron for these wheels is given such an intermediate percentage of silicon that the tendencies toward the formation of graphite on one hand and of cementite on the other are pretty evenly balanced, or, say, between 0.50 and 0.80 per cent. of silicon. Then in the tread of the wheel the carbon is forced into the cementite state by "chilling," i.e., suddenly cooling the tread by making that part of the mold against which the tread rests of cold cast iron. The carbon in the body of the wheel, on the other hand, is led to pass in large part into the state of graphite by the slow cooling of that part of the wheel, caused by making the body of the mold of sand.

Influence of Sulphur

Besides its effect in making the carbon pass into the state of cementite instead of graphite, and thus making the castings hard and brittle, an effect which is usually unwelcome, sulphur makes the iron red-short, i.e., brittle at a red heat, so that it is liable to be torn apart by the stresses which arise because the cooling and contraction of the thicker and inner parts of the casting lag behind those of the thinner and outer parts. It also makes the molten metal sluggish, so that it does not run freely in its molds, and it has no virtues to compensate for these evils. Hence the sulphur present is, except in a few rare cases, that which in spite of us has crept in or stayed in. In case of castings which are to be machined, and hence must be relatively soft, the sulphur should not exceed 0.12 per cent., and in case of thin castings, the metal for which must needs be very fluid, the sulphur should not exceed 0.05 per cent.

Influence of Manganese

Besides habitually (though indeed not always) opposing the formation of graphite, and thus tending to make the cast iron hard, manganese counteracts the red-shortness which sulphur tends to cause, by forming with that sulphur the relatively harmless sulphide of manganese, instead of the harmful sulphide of iron. On this account the percentage of manganese ought to increase with that of sulphur. The better classes of castings usually contain between 0.40 and 0.70 per cent. of manganese, and cast-iron railroad car wheels often contain between 0.15 and 0.30 per cent. But it is possible to use a considerably larger percentage of manganese, and good gray-iron castings have been made with even 2.20 per cent. of it.

Influence of Phosphorus

Phosphorus has the great merit of making the molten metal fluid, but, of course, the great defect of making the cold metal brittle under shock, though this latter effect is much less marked in cast iron than in steel. Thus, whereas steel rails cannot contain more than 0.10 per cent. of phosphorus, and are much better for having very much less, say, 0.08, or better, 0.05 per cent., yet castings which are not exposed to shock may have as much as 1.40 per cent. of this element, if they need great fluidity. Even in gas and water mains, the failure of which may lead to serious consequences, the phosphorus content may rise to 1 per cent. Machinery castings, especially those exposed to moderate shock, should be freer from phosphorus; but even they may contain as much as 0.50 per cent of it. If much sulphur or manganese is present, then the brittleness which they cause by leading to the formation of cementite aggravates the brittleness caused by phosphorus, and calls for a corresponding reduction in the permissible phosphorus content.

The accompanying table gives in a condensed form some of the results of this discussion. In particular, the third and fourth columns show to what feature of the constitution of the several kinds of cast iron the several properties given in the first column are due.

Properties Sought.	Example of Use.	Distribution of Carbon.		Color of Iron.
		Cementite.	Graphite.	
Resistance to shock	Machinery	Little		Very gray.
Softness, easy machining	Machinery	Little		Very gray.
Sharpness of detail, expansion in solidifying	Ornaments		Much	Very gray.
Fluidity (phosphorus)	Pipes	Little		Very grag.
Strength	Car-wheel centers	Moderate		Close gray.
Imperviousness	Hyc. cyls. radiators		Very little	Very close gray.
Hardness	Tread of car wheels	Much		Nearly white.

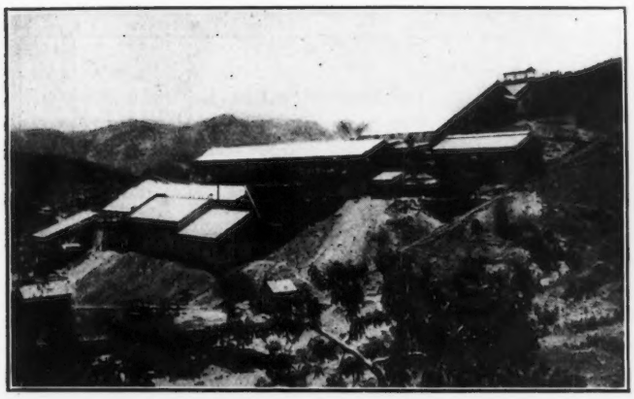
[2] *Stahl und Eisen*, 1907, p. 1565.
[3] *Metallurgie*, 1908, p. 137.

Cyanide Mills, Guanajuato Development Co.—I

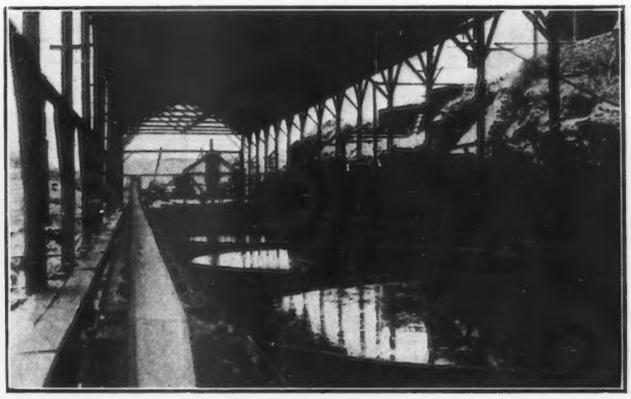
The Nayal Mill Shows the Possibilities of Cyaniding Silver Ores on a Small Scale; the San Prospero Mill Has Two Unique Features

BY CLAUDE T. RICE

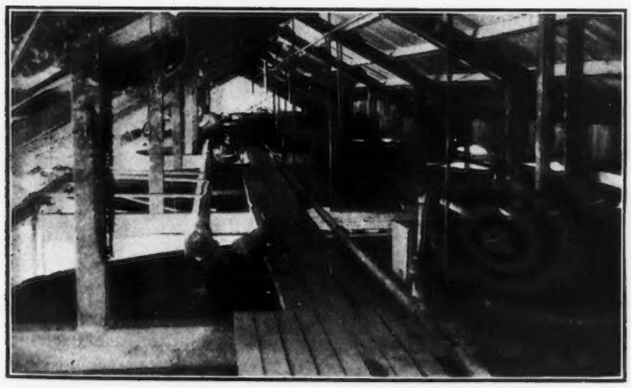
The Guanajuato Development Company, operating mines and mills at Guanajuato, Mexico, is a large holding company. The Nayal, San Próspero, Peregrina and Pinguico mills, which are described in this article, belong to subsidiary companies of the Guanajuato Development Company. The Nayal and San Próspero mills are treating mainly custom ore, while the other two mills treat only company ore. The Nayal mill is interesting as showing what can be accomplished in a small mill treating silver ore. The others are worthy of study because of different details in the mechanical treatment of the ore.



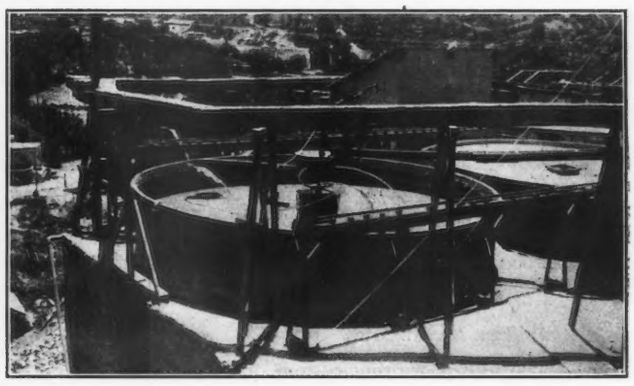
SAN PRÓSPERO MILL



SAND TANKS, SAN PRÓSPERO MILL



SLIME AGITATION TANKS, SAN PRÓSPERO MILL



SAND COLLECTING TANKS, SHOWING SPRINKLER, SAN PRÓSPERO

The feature of the Pinguico mill is the immense *planilla,* or concrete table used for roughly concentrating the slime. It is an improvement on the canvas tables, for with these, after the fiber becomes worn, the efficiency of the canvas tables decreases considerably while the efficiency of the cement table, which is as great as that of a canvas table provided the surface is properly roughened, remains constant. At the Peregrina and San Próspero mills the bucket elevators used to return the pulp from the tube mills to the classifiers are run by a belt from an extension of the discharge neck of the tube mill.

At the San Próspero mill, in order to remove any slime that may still be in the sand going to the sand tanks a revolving lawn-sprinkler is mounted below the sand distributor. This throws jets of solution upon the sand and aids considerably in removing the last slime. At the Pinguico mill it has been found that air agitation in flat-bottomed tanks is not as efficient as mechanical agitation. Consequently a combination mechanical, air agitation of the slime is to be used, the air being retained mainly because a good aëration of the pulp is necessary for high extraction on silver ores.

The curves showing the amount of silver dissolved by the cyanide solution as the pulp goes through the plant and the curve showing the rapidity of solution are very interesting. These were worked out by John S. Butler, assistant general superintendent of the Guanajuato Development Company. I must also thank Mr. Butler for kindly going over my article in order to insure its accuracy and for also adding considerable additional information. At the end of the article will be found a table giving in detail the cost of cyanidation at these mills. The costs have been reduced to these figures since Cortlandt E. Palmer took charge of operations. It shows in a striking manner how much costs depend upon the amount of ore treated by the plant. For this table, and permission to publish it, I thank Mr. Palmer, who is now consulting engineer in charge of operation for the Guanajuato Development Company.

In judging the cyanide practice at Guanajuato it must be remembered that much of the cyanidation of silver ores has been learned through the treatment of the ores at Guanajuato. Therefore, the mills have

not been built for complete sliming of the ore, although the better and quicker extraction on the slime indicate that complete sliming is best for silver ores.

Cyanide men, at least those in Mexico, will be glad to learn that the Guanajuato Development Company is soon to begin to cyanide its concentrates. This plant at the San Próspero mill is almost completed, and will soon be in operation. These rich silver concentrates will be completely slimed. The pulp will be agitated in small Pachuca tanks, and then filtered before being discharged. The plant is small, having a monthly capacity of about 30 tons of concentrates, but it is notable because it is one of the few for cyaniding concentrates and the first for treating by cyanidation a silver concentrate.

At present, after the concentrates are sacked at the mill, the cost of transporting and smelting the concentrates and of marketing the bullion amounts to 12 to 15 per cent. of the gross value of these high-grade silver concentrates. Most of this cost is for smelting, so again the cyanide process has to thank the smelters for extending its domain.

The Nayal Mill

The Nayal mill is treating custom ores entirely. It was originally a pan-amalgamation mill, but when purchased by the Guanajuato Development Company it was remodelled so as to treat the ore by cyanidation.

The mill is equipped with 20 stamps crushing in solution titrating 0.1 per cent. KCN; on the batteries according to the nature of the ore being crushed either 30- or 40-mesh screens are used. The tonnage treated, therefore, varies from 40 to 60 tons per day, of which from 30 to 40 per cent. is crushed to slime. Ten of these stamps weigh 1050 lb. and ten 850 pounds each; they make from 98 to 102 drops, 7 in. high, per minute.

This pulp is concentrated on four Wilfley tables and the middlings from the tables are reconcentrated on another Wilfley table. The tailings from the tables are raised by either an elevator or a 4-in. Butters pump to two cone classifiers which separate the pulp into sand and slime.

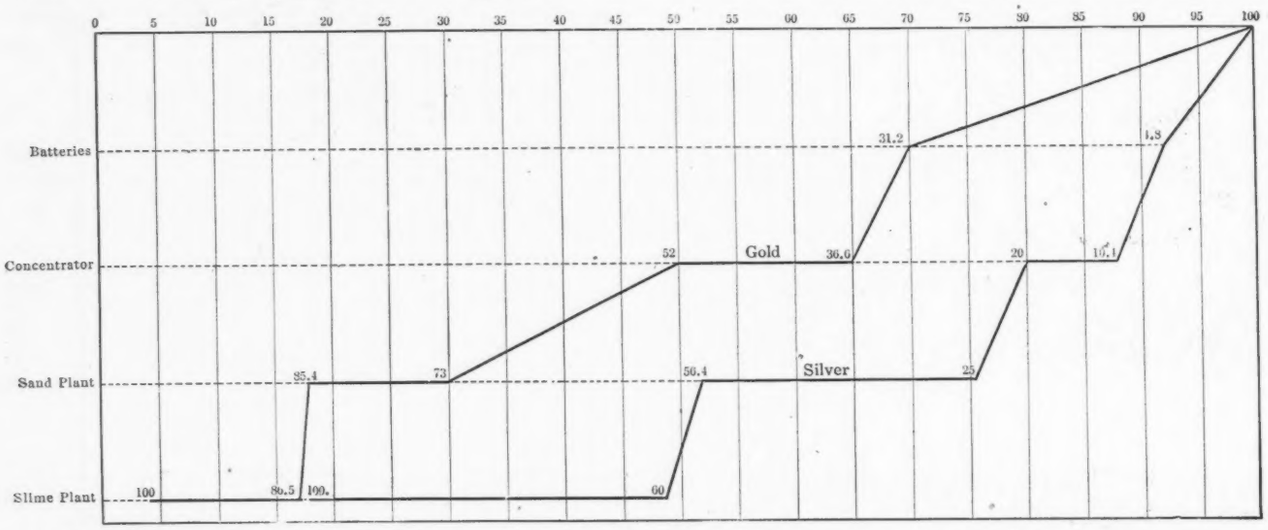
The slime passes to the *planillas*, 5 ft. wide and 15 ft. long, having a grade of 1 in. to the foot; six of these have a riffled cement surface, and two a canvas surface. The slime tailings from the *planillas* go to two settling tanks, 18½x9 ft. deep, the pulp being admitted behind a curtain of cocoa-matting plaited between two pieces of canvas, which extend to within 2 ft. of the bottom of the tank. From the bottom of this settling or thickening tank, a continuous flow of slime is taken through three 3-in. pipes, reduced to ¾ in. orifice, which extend along the bottom to a center line through the tank. On account of the banking-up into cones on the bottom, some slime gives trouble in this type of thickener, but this can be obviated by using more discharge pipes.

The overflowing solution from these thickeners is returned to the mill solution, but the slime pulp is taken to one of 12 slime tanks having the same dimensions as the thickeners, and holding 8 tons of dry slime, since a dilution of 10 to 1 is used during agitation. Some of these flat-bottom tanks are agitated by means of three 3-in. vertical pipes placed in the bottom, and into which compressed air blows through a ¾-in. pipe tapered to a 1/16-in. outlet. Others of these flat bottom tanks are agitated by means of compressed air passing through a hose and a ¾-in. pipe, tapered to a ⅛-in. outlet, which is moved about on the bottom occasionally so as to thoroughly agitate the pulp.

The total length of agitation is 30 hours, and a solution titrating from 0.12 to 0.2 per cent. (average approximately 0.14 per cent.) KCN is used. The slime is given 6 to 7 washes of weak solution; then finally the slime is given a water wash, this being returned to the mill solution. The decanted solution is run to a tank having a sand-filter bottom and then to the weak-solution zinc-boxes. The whole slime treatment lasts approximately 125 hours.

Sand Treatment at Nayal Mill

The sand is collected in a tank 9x10 ft. deep having a side overflow built up by slats as the tank is filled; the overflowing slime is sent to the *planillas*, while the sand after draining is charged by car at a cost of 8 centavos per ton into one of the 17 sand treatment tanks, 15x5 ft. deep, holding about 32 tons of dry sand. There the sand is given a treatment lasting 16 days, consisting of 24 washes with strong solution, titrating 0.4 KCN, and 4 washes with water. The tanks are discharged through doors in the bottom, and the tailings are trammed to the dump for 10 centavos per ton.



CURVES SHOWING RATE OF SOLUTION OF GOLD AND SILVER IN SAN PRÓSPERO MILL WHILE CRUSHING IN CYANIDE SOLUTION
(Figures on curves are in per cent. of total gold or silver extracted.)

The strong solution is sent to the strong-solution zinc-boxes and the water washes to the weak-solution boxes after passing through the respective head tanks, which have sand-filter bottoms. About 110 tons of strong solution are used per charge of sand, and 150 tons of weak solution per charge of slime.

In the zinc room there are two strong and two weak-solution zinc-boxes having five compartments 2½x3 ft. in area, holding roughly 7 cu.ft. of zinc each. In cleaning up, the shorts that will not pass a 40-mesh screen are returned to the first two compartments of the strong solution zinc-boxes where they are placed loose in trays suspended above the zinc shavings. Bullion 920 fine is obtained.

With this small equipment an extraction of 76 per cent. is made on silver and 94 per cent. on the gold. The cyanide consumption is 1019 grams per ton, the lead acetate consumption 228 grams per ton

of ore crushed; it takes 94 h.p. to run the mill. The cost of milling and cyaniding in this small mill is 5 pesos per ton of ore crushed, being only about 1.85 pesos per ton more than the cheapest cost in the district.

The San Próspero Mill

The San Próspero, or as it is often called the San Matias mill, is treating not only ore from the San Próspero mine, but also custom ore. The mill has been in continuous operation since November, 1906. At present it is treating 150 tons of ore a day, the stamps duty being 3.7 tons in 24 hours. The purchased ore is sampled as it is dumped into the crusher bins, and the samples quartered down by hand on the sampling *patio*, the sample being recrushed in a small crusher. The mill is built on a slide-hill, sloping 24 deg., and after entering the bins, the ore is handled entirely by machinery or gravity. The mill is run by electric power, the three-phase, 60-cycle, 15,000-volt current being transformed to 440 volts.

The ore from the crusher bin feeds by gravity to a No. 3 McCully gyratory crusher, which breaks the ore so as to pass 1¼-in. ring. This ore is then conveyed by a 16-in. Robins belt conveyer to a cross belt over the 370-ton battery bin, into which the ore is dumped by means of a Robins movable tripper. Each conveyer belt is operated by a 3-h.p. Westinghouse motor.

The ore is fed by belt-driven Challenge feeders of the Davis type to 40 stamps, weighing 1050 lb. each, and making 104 drops 6½ in. high per min. The crushing is done in cyanide solution, titrating 0.1 to 0.15 per cent. KCN. The sills of the mill bin butt up against the battery posts, which are held against these sills and the upper braces by means of bolts anchored into masonry behind the bins; the battery posts of Oregon pine stand in cast-iron shoes, which are secured by anchor bolts to the concrete mortar blocks. "El Oro" solid stamp guides are used; the cams are fastened to the cam shaft by Blanton keys. The mortars, weighing 7500 lb., are anchored by 1½-in. bolts directly to the concrete mortar-blocks.

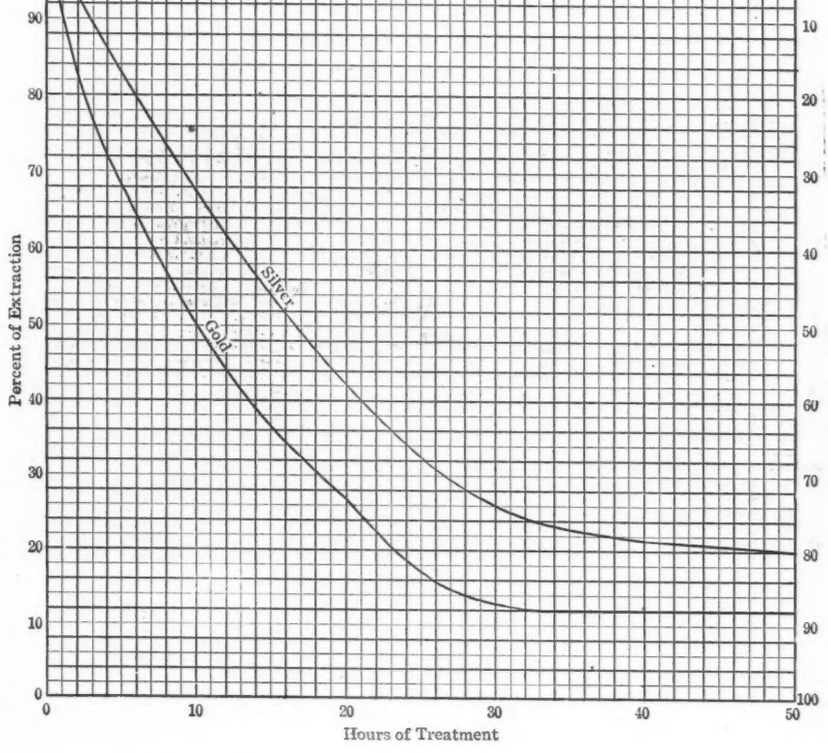
The stamps are run in units of 20, each unit being driven by a 50-h.p. motor, and each 10 stamps by a separate belt from the unit line shaft. Owing to the fact that there is only one tube mill now in operation, 30-mesh Tyler rolled-slot screens are used on the batteries. The stamps drop in the order, 1, 3, 5, 2, 4, prevalent in the district; about seven tons of solution are used per ton of ore crushed.

The pulp from the batteries goes to eight No. 3 Wilfley tables, one table being provided for treating the product of each five stamps. Each 10 stamps feed to a dewatering cone which thickens the pulp and eliminates a certain amount of slime before concentration. The slime overflow goes direct to the cement table. This cement table is 72 ft. wide and 27 ft. long (in the direction of flow); it has a grade of ⅛ in. per ft., and is divided into 16 sections. On this a rough concentration of the slimed sulphides is made; this concentrate is subsequently cleaned on a vanner. The tailings from the cement table go directly to the slime plant, but the tailings from the vanner are sent to the sand classifiers above the sand-collecting tanks.

Bucket Elevator Driven by Belt from Tube Mill

The cement table concentrates the ore about 2600 to 1, saving about 3 per cent. of the total value of the ore; the Wilfley tables concentrate the ore 230 to 1, and about 24 per cent. of the total ore value is saved on them. The tailings from the Wilfley tables go to two thickening cones, 30x36 in. deep, from which the underflow, thickened so as to carry 3 parts of water to 2 parts of sand, feeds to a tube mill 14x5 ft. diameter, revolving at 29 r.p.m., and driven by a 35-h.p. motor. Lumps of hard ore and Danish pebbles are used for crushing; the mill is lined with cast-iron liners. About 60 to 70 kg. of pebbles and 1000 kg. of hard ore are fed to the mill each day; the ore and pebbles for grinding are fed at frequent intervals without stopping the mill through an extension of the feed neck, instead of once a week as at the Peregrina mill. The pulp discharged from the tube mill is raised by a bucket elevator, driven from a pulley fastened to the rear trunnion of the tube mill, to the thickening cone above the tube mill, the coarse sand, of course, returning to the tube mill. This is the first time that bucket elevators have been driven from the extension of the tube-mill trunnion, but the mode of drive works very satisfactorily and is very convenient.

The overflow from the thickening cone goes to two separating cones, one 8x8 ft. deep, and the other 7x8 ft.; the underflow from the first goes to three 30-in. cones and the underflow from the second large cone goes to another 30-in. cone.; thus, the pulp is separated into sand and slime.



CURVES SHOWING RAPIDITY OF SOLUTION IN SLIME TREATMENT, SAN PRÓSPERO MILL

Sand Treatment at the San Próspero Mill

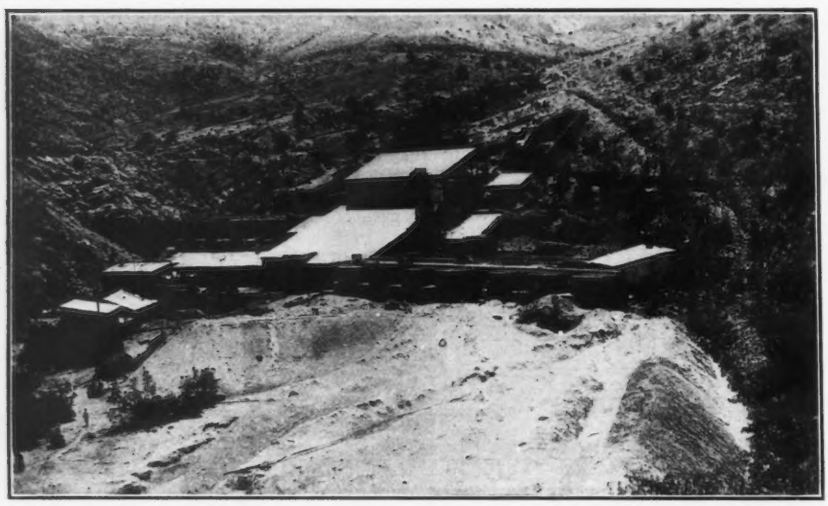
The sand from these cones goes first to one of two collecting tanks, 28x6 ft. deep. These have a central slat overflow, and the sand is fed to them by a two-armed Blaisdell distributer. On top of the central slat-box is an ordinary lawn sprinkler (see accompanying illustration), which throws a stream of solution onto the sand and washes through the slat-box any slime that may have passed the cones. By raising or lowering the arms of the sprinkler the distance that the water is thrown can be regulated. The overflowing slime and fine sand is pumped back

to the separating cones. After the central slat-box has been pulled out, a Blaisdell excavator and distributer system is used for transferring the sand to one of the eight sand-treatment tanks having the same dimensions as the collecting tanks. The residues are discharged by the Blaisdell excavator onto a Robins belt conveyer and taken to the dump.

As 60 per cent. of the ore crushed is sand, it takes 38 hours to fill a collecting tank holding about 127 tons of dry sand. The tank is allowed to drain about 12 hours; transferring consumes about 2½ hours. Then the treatment, which lasts from eight to nine days, begins.

The first 30 washes of 10 tons each titrate from 0.45 to 0.5 KCN. It takes about 3½ to 4 hours for each wash to pass through the charge. Then 17 to 18 washes (10 tons each) of solution titrating from 0.1 to 0.15 KCN are used; and finally 6 or 8 water washes are given to each tank. The strong washes go to the strong-solution head tank above the zinc-boxes, but the weak washes and the water washes go to the weak-solution head tanks; these tanks have sand-filter bottoms.

Sizing tests on the sand gives the following percentages by weight: On 40 mesh, 3; 40 to 60 mesh, 37; 60 to 100 mesh, 21; 100 to 150 mesh, 23; 150 to 200 mesh, 6; through 200 mesh, 10.



THE NAYAL MILL

Slime Treatment at San Próspero Mill

The slime overflow from the cone separators goes to two slime thickeners, 26x12 ft. deep. The feed enters these through a box extending 6 ft. into the tank so that clear solution overflows as the settler fills. The thickened slime underflow goes to one of six agitation tanks (same size as the thickeners) where the 96-hour slime treatment with solution titrating 0.12 to 0.16 per cent. KCN begins. The first agitation lasts 12 hours; settling 10 hours; decantation, 2 hours. Then the pulp is given five agitations; the first lasts 6 hours and the others 4 hours, these agitation periods being separated by settling-decanting periods lasting 10 hours. At the end of this treatment the tank is filled with water, and the charge transferred to the masonry tanks above the Butters filter.

The slime tanks are agitated both by worm-driven agitation arms, carrying air pipes from which air escapes through short jets, and by a 6-in. centrifugal pump, taking the pulp from the bottom and discharging it at the top of the tank. The agitator arms make 1½ r.p.m.; one 6-in. pump is installed for every two tanks.

The Butters filter, having 60 standard-size frames, works under a vacuum of from 20 to 22 in., and a cake from 0.6 to 1 in. thick is formed. The cycle of operation for treating five tons of slime is: Filling, 5 min.; making cake, 40; returning slime pulp, 15; filling with water, 5; washing cake, 30; returning waste water, 15; discharging cake, 10 min.; total, two hours.

The cost per ton for filtering, when a five-ton charge is treated and a 1-in. cake is formed, is: Labor, 9 centavos; acid, 5; power, 17; repairs, 3; total cost per ton, 34 centavos. This cost is based on a consumption of 25 horsepower.

All the washes from the agitation tanks and from the Butters filters are sent to two sand filters that feed to the weak-solution zinc-boxes.

In the precipitation room there are two strong-solution and five weak-solution zinc-boxes, each having five compartments, 36x36x36 in., with bottoms sloping toward the launder placed below each box. The screens are placed 6 in. above the bottom of the boxes so that 30 in. are available for zinc shavings. The flow of solution through the weak-solution boxes is regulated to 5 or 6 tons per hour, while the flow through the strong-solution boxes is 2½ tons per hour.

The precipitate is washed through an 80-mesh screen; the short zinc is put back on top of the zinc shavings in the first compartment of the strong-solution boxes and allowed to accumulate until there is too large an accumulation of short zinc; then it is treated with acid.

The precipitate goes through the screen to a sump, and then is charged by a Snow pump to a 24-in. Shriver filter-press. In this the cake is dried by hot air; the cake is fluxed loose in No. 300 crucibles and melted, there being four furnaces. The first bullion bars are remelted, and clean bars 905 fine are obtained. Clean-ups are made four times a month.

Aldrich "Allentown" triplex pumps are used throughout the mill. An 8x9-in. pump returns the mill solution from the mill-solution sump tank to the mill-solution tank, a 7x9-in. pump returns the weak solution, and a 5x5-in. pump the strong solution, all three pumps being in duplicate.

Consumption of Chemicals

The capacity of the mill-solution tank is 354 tons, and both the weak-solution tank and the strong-solution tank hold 90 tons each. Fresh water is added only as washes to the slime and sand charges, and sodium cyanide is added in the sump tanks. The strength of the weak solution and the mill solution is regulated by pumping from this supply so that an absolute regulation of this strength is obtained. The consumption of cyanide is 0.8 kg. per ton of ore milled and the zinc used amounts to 0.37 kg. per ton. About 0.07 kg. lead acetate is added per ton to keep the solution from fouling.

Curves accompanying this article show the rate at which the solution dissolves the gold and silver during the treatment. The figures on the curves, showing the amount of metals dissolved at different points in the mill treatment, indicate the percentage of the actual gold or silver recovery that has already been dissolved by the time that those points in the mill treatment have been reached.

Mexican Dynamite Concession

According to a new agreement made between the Mexican Government and the Mexican National Dynamite and Explosive Company, the time for the operation of the syndicate is extended for 25 years from March, 1908, or until 1933, instead of until 1917, as agreed upon in the contract of 1905. During this time the Government guarantees not to grant a similar concession to other individuals, nor to set aside the special tax on the article in favor of any producer, manufacturer, or importer, whether native or foreign, of any dynamite or other explosive the base of which is nitroglycerin or other similar explosive substance.

Principles of Machine Sampling

The Elements Which Govern the Operation of Automatic Samplers; Inherent Defects and Possible Methods for Remedying Their Faults

BY JOHN A. CHURCH*

There has been discussion enough on the subject of continuous sampling by machines to disclose the elements which control the work, but before taking them up it is proper to come to an agreement upon what may be accepted as really good sampling; and in this connection it will be well to republish Paul Johnson's tables of his comparative work (ENG. AND MIN. JOURN., April 12, 1902), for they are probably not within reach of the present readers of the JOURNAL.

PAUL JOHNSON'S COMPARATIVE SAMPLING (THE JOURNAL, APRIL 12, 1902).

Sample.	Lot No.	Tons.	Cu. Per Cent. Wet.	Dif. in Lb.	Au. Oz.	Ag. Oz.
a	1	32	6.6	4	0.04	1.00
b	1	32	6.4		0.03	1.25
a	2	65	6.10		0.12	1.80
b	2	65	6.15	1	0.12	1.70
a	3	110	3.85	1	0.01	2.17
b	3	110	3.80		0.01	2.20
a	4	150	1.70	0	0.145	0.34
b	4	150	1.70		0.150	0.33
a	5	27	1.70	0	0.52	1.30
b	5	27	1.68		0.48	1.39
a	6	32	0.90		0.15	0.41
b	6	32	0.93	0	0.14	0.42
a	7	60	0.88		0.20	0.45
b	7	60	0.90	0	0.18	0.44
a	8	17	0.00		0.74	5.60
b	8	17	0.00		0.72	5.62
a	9	30	0.00		0.36	2.00
b	9	30	0.00		0.34	1.90
a	10	110	0.00		0.29	9.70
b	10	110	0.00		0.27	9.60
a	11	17	0.00		0.04	25.70
b	11	17	0.00		0.04	26.40

ANALYSES OF THE ORES SAMPLED.

Lot No.	Insoluble, Per Cent.	Silica, Per Cent.	Iron Oxide, Per Cent.	Lime, Per Cent.	Sulphur, Per Cent.
1	51.6	32.6	14.8	4.1	10.9
2	54.2	52.0	12.6	3.8	tr.
3	37.4	29.5	16.7	17.8	6.4
4	42.1	38.0	23.2	13.1	2.4
5	50.1	37.5	19.3	3.4	12.0
6	30.4	33.1	26.5	tr.	18.6
7	34.7	29.6	26.7	tr.	18.3
8	90.2	89.5	3.3	tr.	1.2
9	93.0	91.7	2.3	tr.	0.7
10	84.5	82.1	4.2	..	3.3
11	63.7	63.1	10.1	tr.	11.6

I presume that No. 6 should read 36.4 insoluble, but I give it as printed.

Undoubtedly this is remarkably good work; and the fun of it is that Johnson had not one of the improvements that Vezin, Argall and I advocate and even present as necessary. His mill, however, has one of the essentials to good work which I pointed out in my first article and which compensates largely for the absence of special devices. There is haphazard feed all the way down to the last crusher, where there is an apron; but the mill, being built to utilize a low elevation, is remarkably compact, as is shown by the accompanying illustration which represents a cross-section of the mill and the arrangement of the machines. The first and second crushers and first and second samplers are grouped into one unit, and the machines are set closely together with small drop between them. The second cut is elevated to the top of the mill and falls (apparently about 10 ft.) to the second group of third and fourth crushers and samplers, which are grouped together so closely that the whole system appears to have a hight of not more than 15 or 16 ft. (no scale is given). This compact arrangement counteracts the tendency to acceleration.

With this mill Mr. Johnson resampled the lots of ore given by number. There are only three of them that can be considered instructive, for the only way to escape the effects of assay errors is to test ores that have enough metal to make the assay error unimportant in proportion. The lots 1 to 3 with 6.6, 6.10 and 3.85 per cent. copper are the only ones in the series that satisfy this requirement. The differences in the two samplings of these lots were four, one and one pound copper per ton.

ELEMENTS OF SAMPLING

I am glad to have Mr. Mathewson's correction of my calculations on his resampling data, and wish on my part to correct an impression which I get from both of his letters, that I am criticizing somebody's machine in comparison with somebody's else. I think your readers will not be able to find in my writings any such preference or disapproval. I have purposely avoided any word that might be taken as criticism of any one of the sampling machines, for my object has been to ascertain the principles that underlie their use, and what I have written applies to all of them.

Before a proper sampler can be built, it is necessary to determine the elements of its use, the weight of cut, speed in the sampling circle, and frequency. If engineers come to an agreement on these things which they do not appear to have done yet, any of the sampling machines can be altered to satisfy the conditions imposed. In fact this is done now. Any engineer who has views upon these subjects has only to inform the makers and he will find them very willing to make such changes in size of scoop and driving pulley as he desires.

The columns of the JOURNAL bear me out in saying that sampling mills are built now with a frequency unknown even five years ago. I think they will be much more common five years hence, and that the mining business is on the eve of a general introduction of machine sampling in all important installations. At present the work done is so irregular that I feel it is high time the whole engineering profession should consider the question and determine what can be done to improve the work. I am contributing my mite only because no one else has come forward to discuss these important questions.

NEED OF MORE DATA

In expressing the obligations of the profession to Messrs. Mathewson and Johnson for publishing data of their work I spoke with honest thanks. It is necessary to know the present state of the art if we are to improve it, and I doubt if sound improvement can come from the closely guarded results of tests in any one establishment. It would be a good thing if every mill in the country would make a series of comparative resamplings, and publish the results. The worse they are the more good can be done by giving them to the profession for consideration. Mr. Mathewson says that both the mills he used had all the improvements I referred to, and out of 13 resamplings there were five that gave such differences as 8, 11, 8.6, 12.6 and 18.6 lb. copper per ton. The reassay reduces the 8 lb. to 5.6 lb., and the 11 lb. to 9.2 lb., no reassay of the others being given.* It is noticeable that all the reassays are lower than the *B* series, except one which is 0.02 per cent. higher; while all the *B* resamplings are lower than the *A* series except two, and while the reassay altered the figures of these two they still left them higher in *B* than in *A*; from which I conclude that the difference in the two series of samplings are real. My observation of sampling mills has convinced me that this is at least fair average work of mills as designed and operated at present. Still I do not consider it satisfactory, and I believe that careful consideration of the principles which govern the work will give us a system of sampling that will be fair and satisfactory. The object of this present writing is to discuss the elements that affect the taking of a sample, but first it is necessary to consider the maximum variation that can be allowed.

MAXIMUM VARIATION

No sampling system can be expected to work with perfection, but I think an allowed variation of 5 lb. metal per ton of ore is not below a proper and attainable standard. On the contrary, as mills sometimes do better work it is our duty to find

*Mining engineer, 15 William street, New York.

out how they do it, and to make this better work the uniform practice; and this is the burden of the last article with which I shall trouble you. Five pounds per ton is 12.5, 8.33 and 6.25 per cent. on ores containing 2, 3 and 4 per cent. metal which form such a large part of our present output.

Quantity Needed for Fair Sampling

Taking the ore as sent to the mill, without regard to the mode of selecting it, the first question is what proportion to take for the first cut. Brunton has shown that this depends primarily on the size of the largest fragments. One example of crushing to 2½ in. in a gyratory machine gave the following sizes and proportions.

	Per Cent.
On 2½ in.	3.0
2½ to 2	5.3
2 to 1½	24.2
1½ to 1	35.0
1 to ¾	9.9
¾ to ½	8.4
½ to ¼	6.3
¼ to ⅛	3.2
Through ⅛	4.7

Brunton calculated that a lot composed entirely of 2½-in. size should contain not less than 300 tons for accurate sampling and by his table the greatest quantity required for any of the above sizes is 36 tons (for 24.2 per cent. of 2 in.) Therefore a 40-ton lot breaking in about the above proportions should give a fair sample of any size it contains.

Number of Cuts and Crushings

Most mills make four cuts and crushings in preparing a sample for the sample grinder, after which the treatment of the small quantity of finely ground ore depends upon local conditions, whether the ore contains "metallics," etc. Sometimes only three are made, or even two. The higher number is commendable.

Size of First Cut

The great importance of the size of the first cut has been emphasized by Argall who recommends 25 per cent., with which recommendation I agree though with reluctance. Sampling is a greater or less burden in proportion to the percentage of the first cut. At present I think it should not be less than 20 per cent., but, if we understood the work so well that we could trust it thoroughly, I do not see why 10 per cent. should not be enough. All above that seems to me margin to cover our deficiencies.

The size of the subsequent cuts is less important, for Brunton figured that if 2½ in. required a sample quantity of 300 tons, 1 in. requires only 18 tons, and ¾ in. 8.5 tons, to give the same degree of accuracy. Engineers have not been willing to embody these conclusions in their plans, though they are mathematically correct, and usually make the second cut 10 per cent. and often 15 per cent. In subsequent cuts the ore is so fine that the proportion taken is mainly directed to getting the weight of final sample desired. After reaching the sample grinder the system of quartering is followed usually.

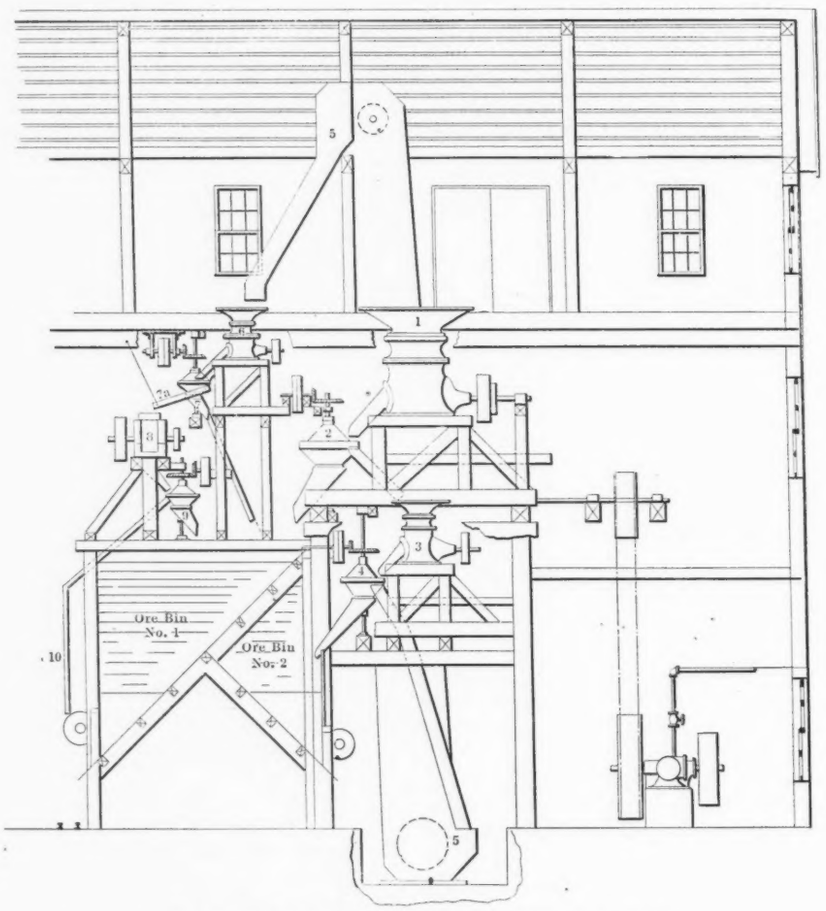
Recrushing

Practically 2½-in. material is the coarsest ore that should be sampled, and when one-half the ore is above that size the lot will give in crushing about 8 per cent. that will go through a ¼-in. ring. In a 400-ton mill the first cut gives 80 tons for recrushing, about 20 tons of which will be fines. A 15-per cent. second cut from this will take three tons of fine and nine tons of coarse ore, all of which will enter the fines in the next crushing, so that the whole quantity of fines made will be 29 tons, or 7.25 per cent. on 400 tons. Eighty tons allows good sampling to be done on 1½-in. material; and when sampling blast-furnace ore, where fines are to be avoided, I should not hesitate to break to 1½ in. in the second crushing. The succeeding reductions will have to be about in the ratio one to five instead of the usual ratio one to four in order to bring the last reduction down to 1/16 in.; but this is not seriously objectionable.

Weight of the Cut

The weight, especially the first cut, is another very important question. In my last letter I pointed out that Johnson stands almost alone in advocating a very low speed, 70 ft. a minute, of the scoop; and his success indicates that he may have hit upon a valuable principle. The great variations in our present practice which variations of speed produce will be seen by comparing the amount of ore passing the machines while taking the first cut, on an ore supply of 400 tons in eight hours.

This is supposed to be on a 2½-in. ore. The only result of increasing the size of the cut that I can see is to increase the probability of getting into the cut ore fragments that started together. Your correspondents think this is of no importance, and if the ore were mixed thoroughly I should agree with them; but in continuous progressive sampling I still think that means should be taken to secure this result and that success in this particular will increase the accuracy of sampling. Compact arrangement and large cut at low speed are the only elements making for good sampling that I can discover in the most successful test on record.



SAMPLING MILL, BRITISH COLUMBIA COPPER COMPANY

(1) No. 5 Gates Crusher. (2) No. 1 Johnson Sampler. (3) No. 2 Gates Crusher. (4) No. 2 Johnson Sampler. (5) Bucket Elevator. (6) No. 0 Gates Crusher. (7) No. 3 Johnson Sampler. (8) Reliance Rolls. (9) No. 3 Johnson Sampler. (10) Rocking Spout.

Frequency

If a large cut is really so important the frequency must be low and I think the

Vezin sampler with its speed of 20 r.p.m. should be run with only one scoop which would give 9600 cuts in 8 hours. Each cut would take 8.3 lb. out of 83.3 lb. run. With a sampling diameter of 38 in. the circumference is 119 in. and a scoop for 20 per cent. cut would be 23.9 in. wide. We shall see presently what effect this would have on the sample. But is it necessary to use machines as large as 38 in. diameter in the sampling circle? I see no objection to using Vezin's smaller machine with 31 in. diameter on 2½-in. ore. A 20 per cent. scoop would then be 19.5 in. wide.

Speed of Cut

Continuous sampling deals with very small time spaces as the accompanying comparison of the way the different machines work shows.

The data taken for the Johnson machines are mere guesses, as I have no blueprints of them; but they cannot be far enough from the truth to destroy the striking comparison in the time of cut. "The time of cut 1" in the table is the time in which the whole scoop passes any one point in its circle. "Time of cut 2" is the time required to pass completely a spout 8 in., 6 in. and 4 in. wide, respectively, for the different sizes of ore and machine; in other words, the whole time from the instant when the near side of the scoop comes under the spout to the instant when the far side passes away from the spout. Taking only the largest machines and first cut the times of the entire passage are 0.50, 0.96, 0.84 and 1.42 sec. for 4 to 12 lb. of ore to enter the cut. The spout widths I take are only two-thirds the usual widths.

SPEEDS OF SAMPLING MACHINES (10 PER CENT. CUT IN EACH SCOOP).

Johnson	1 scoop	7 cuts x 480	3,360	238	lb.	per cut	23.8 lb.
Johnson	2 scoops	14 cuts x 480	6,720	119		"	11.9
Snyder	2 scoops	20 cuts x 480	9,600	83.3		"	8.3
Simplex	2 scoops	22 cuts x 480	10,500	76.2		"	7.6
Vezin	2 scoops	40 cuts x 480	19,200	41.7		"	4.2

Machine.	Speed Per Second, Inches.	Sample Circle, Inches.	Width 1 Scoop 10 Per Cent. Cut, In.	Time of Cut, Seconds.	
				1	2
Simplex 64 in	27	147	14.7	0.54	0.84
Simplex 44 in	24	94	9.4	0.39	0.64
Simplex 28 in	21.4	53	5.3	0.25	0.44
Snyder 60 in	22	132	13.2	0.60	0.96
Snyder 42 in	17	72	7.2	0.42	0.77
Snyder 27 in	11	47	4.7	0.43	0.76
Vezin No. 2	39.8	119	11.9	0.30	0.50
Vezin No. 1	32.4	97	9.7	0.30	0.49
Johnson No. 1	14	119	11.9	0.85	1.42
Johnson No. 2	14.5	97	9.7	0.67	1.08
Johnson No. 3	10.6	53	5.3	0.50	0.88

It is well known that all sampling machines are subject to a uniform source of error. As the near side of the scoop passes under the area of the spout ore of 2-in. size cannot fall into the sample until the edge of the scoop has passed 2 in. beyond the edge of the spout, but fine ore is going into the sample all the time. This selective sampling is repeated as the scoop leaves the spout. If the scoop is 12 in. and the spout 8 in. wide this selective sampling continues for one-fifth of the time for all ore of 2 in. and above, which is at least one-fifth of the whole. The peculiarity is that this is a cumulative effect and never alternates from plus to minus. If the coarse ore is of poorer quality than the fine the sample is too rich and *vice versa*. This defect is inherent in all automatic sampling machines.

Design of Machines

It is evident that the design of machines must embody whatever principles are accepted as necessary to good sampling. My belief is that the weight of the first cut has greater importance than has been suspected, for the reason that the inherent defect of automatic sampling is felt most severely in the treatment of coarse ore. If the whole path of the scoop is 20 in. (12-in. scoop, 8-in. spout) and there is selective sampling for 4 in. this cause of discrepancy lasts for 20 per cent. of the cut, and if the lot contains 20 per cent. of 2-in. ore and larger, in a lot of 400 tons there is 80 tons that will not be fairly represented in the sample.

I think the first effort of millmen should be directed to reducing this error. It can be done by using one large scoop where two smaller are used now. The width of a single scoop for a 20-per cent. cut is large on the large machines, being 29.4 in. in the Simplex, 26.4 in the Snyder, and 23.8 in. for the Vezin and Johnson. Is there any objection to such large scoops? This brings us to the question of size of machines. If the medium size is used the width of scoop will be 18.8 in., 14.4 in. and 19.4 in. These seem to be practicable sizes. My judgment is that these sizes are large enough for 2½-in. ore, and that the task of ascertaining the effect of a heavy cut will not be difficult.

Speed and frequency are correlations of weight. Assuming an eight-hour day and 400 tons, we have 1667 lb. a minute. If 15 r.p.m. is thought to be sufficient, a 20-per cent. cut would have a weight of 22.2 lb. which appears to be a good weight to begin on.

Mixing

I have explained sufficiently in my first article my reasons for believing that a sampler should never run empty at one time and flooded at another. The problem of managing a continuous ore stream so that it will be sampled as well as if it had been stopped, mixed and resampled as a new stock of ore is important; and the more I see of sampling results the more convinced I am that the cause of discrepancies, apart from the one spoken of under "Speed of Cut," is to be found in this part of the work. The three methods suggested for correcting the trouble are Vezin's mixer, shaking spouts and compact arrangement of the machines. The first two are practically the same. I do not know of any addition to this list for mills that have to sample various ores. A mill that has only one ore to work on can put in small bins after each crusher but they would require too much cleaning up to allow frequent changes of ore.

It is evident that this error can be avoided by screening and sampling the coarse and fine separately, and perhaps this may be found necessary in the first cut.

Conclusions

This discussion has not lessened but increased the conviction reached by years of observation that the present state of sampling by machines is unsatisfactory. Large sums change hands every year on the results given by these mills and these sums are on the increase, but how many of the mills can be trusted to do their work closer than 10 lb. gain or loss per ton of ore? I notice a prevalent feeling that the case can hardly be as bad as I have shown it in a country where every branch of mining is studied so well as in America, and that the subject must be better understood than my letters suggest. But who understands it? The plans of new mills that I have seen show such diversity that no accepted basis of design can be discerned.

The only remedy for the existing diversities in design is experiment. There have been hundreds of tests made in American sampling mills but they have been mostly for the purpose of comparing machines, or the end results of machine and hand sampling. I cannot say that none of them has been directed to trying out methods of work, but this important branch of the subject seems to have been comparatively neglected. Who, for instance, can tell us as the result of careful and thorough trials which will give the most trustworthy and accurate results, a 10-lb. cut taken 12,000 times or a 15-lb. cut taken 8000 times? This and the other elements of the problem are the true field for experiment, and until it is undertaken the seller and buyer of ore must be in a state of uncertainty whether they are paying for and getting paid for 10 lb. of metal too much or too little.

Kafirs on the Rand in South Africa are paid 1c. per inch for hand drilling in hard rock, with a bonus for drilling more than a certain footage per shift. Practically all hand drilling is single hand.

Growth of the Cananea Copper Smelting Works

By Charles F. Shelby*

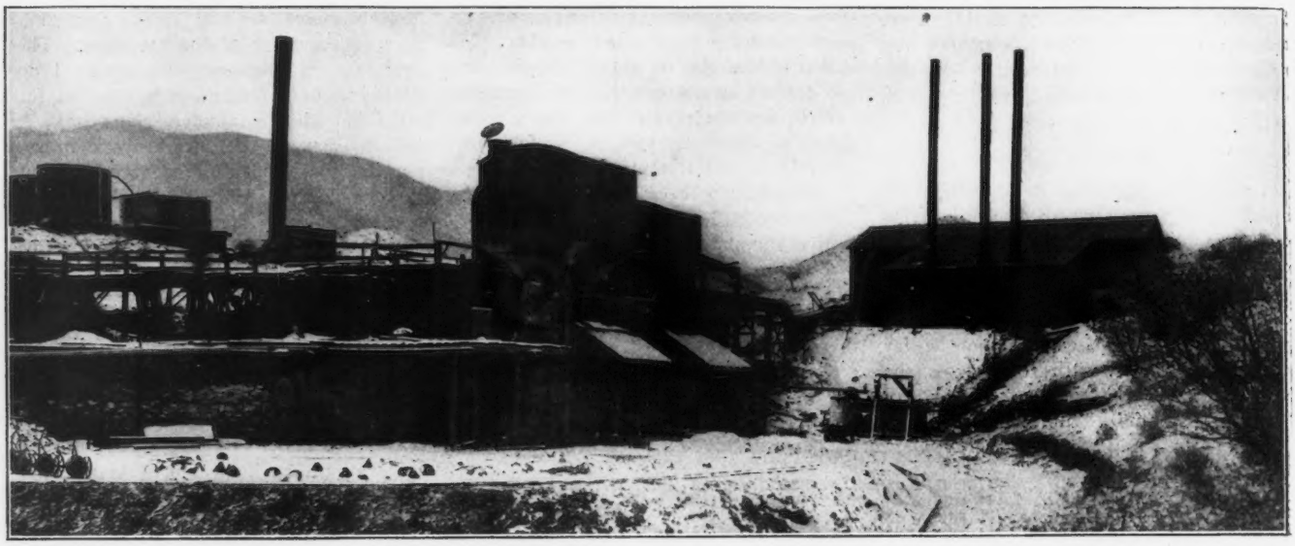
The accompanying illustrations show some of the changes which have taken place at the smelting plant of the Cananea Consolidated Copper Company at Cananea, Sonora, Mexico, during the last few years. The original plant included two blast furnaces of which the first unit went into blast in the summer of 1899. In February, 1907, the plant had grown to eight furnaces, the largest being 210 in. at the tuyeres. The eighth furnace was practically the same as those in use at Anaconda before the large Mathewson furnaces were installed.

One of the illustrations shows the condition of the converter department in July, 1906, immediately after the riots when labor was scarce and inefficient, and the company was doing its best to maintain its regular output of copper under these trying circumstances.

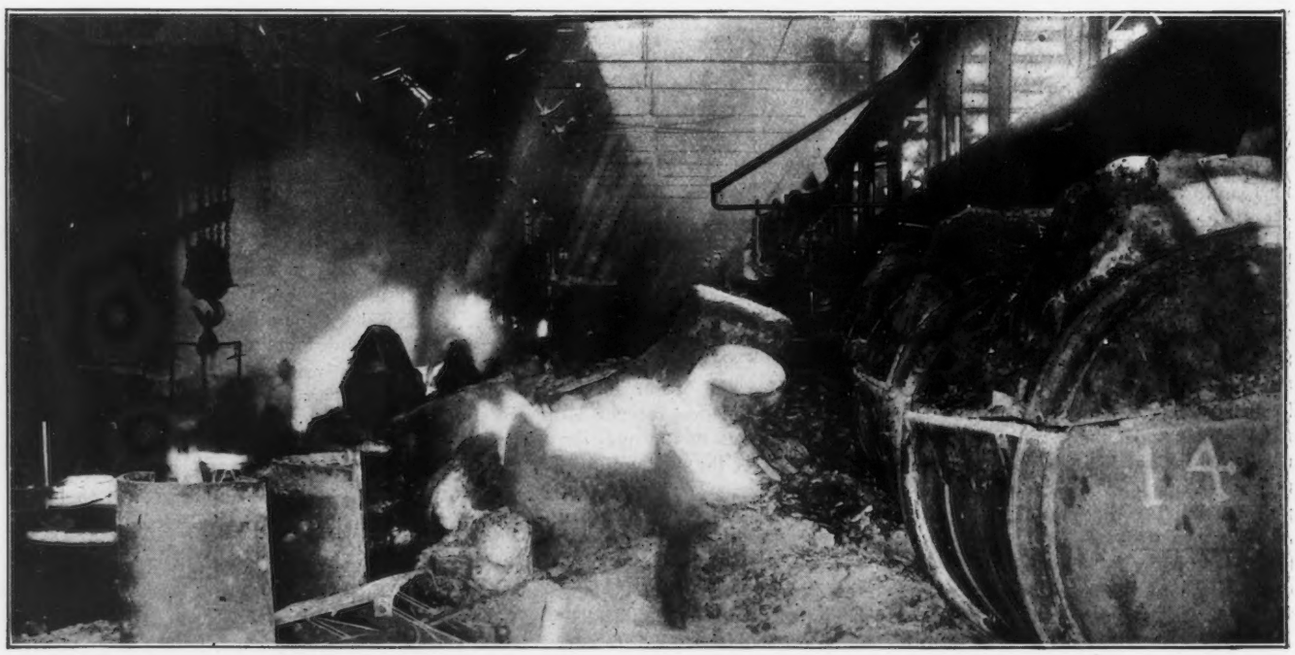
The eight new furnaces which have been installed upon the site of the old furnaces during the last year are shown in two of the illustrations. The view of the feed floor shows the new method of charging which eliminates hand labor almost entirely. This installation is giving entire satisfaction.

The remodeled converter department is the subject of the two remaining illustrations. Here are five stands and 20 shells. All the machinery is electrically operated. The view of the single converter shows a number of new and interesting features.

The Carmichael-Bradford process, with improvements and modifications, is now being used more largely by the Broken Hill Proprietary Company, and with more advantageous results. The benefits from this process result from its being cheaper to work, while the loss of lead is reduced as compared with the ordinary method of roasting lead ore before smelting.

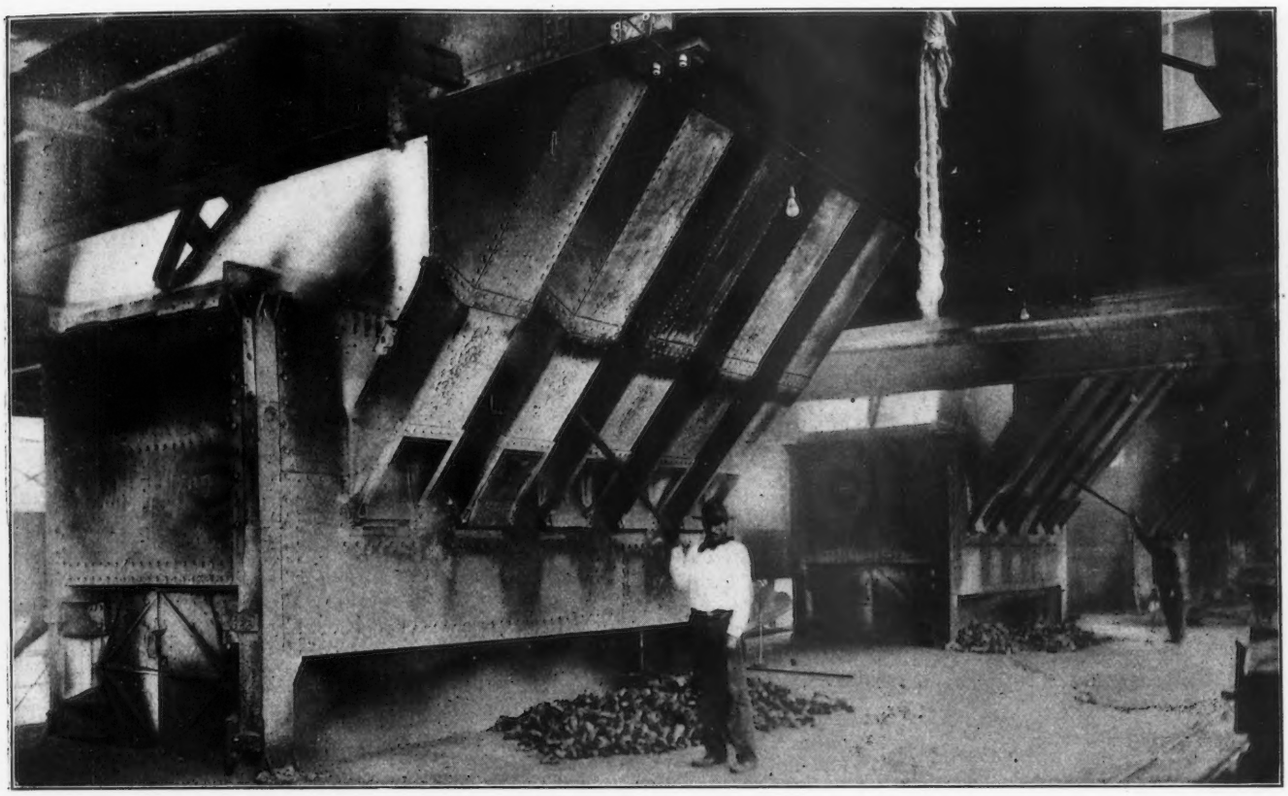


ORIGINAL PLANT, CANANEA CONSOLIDATED COPPER COMPANY, CANANEA, MEXICO

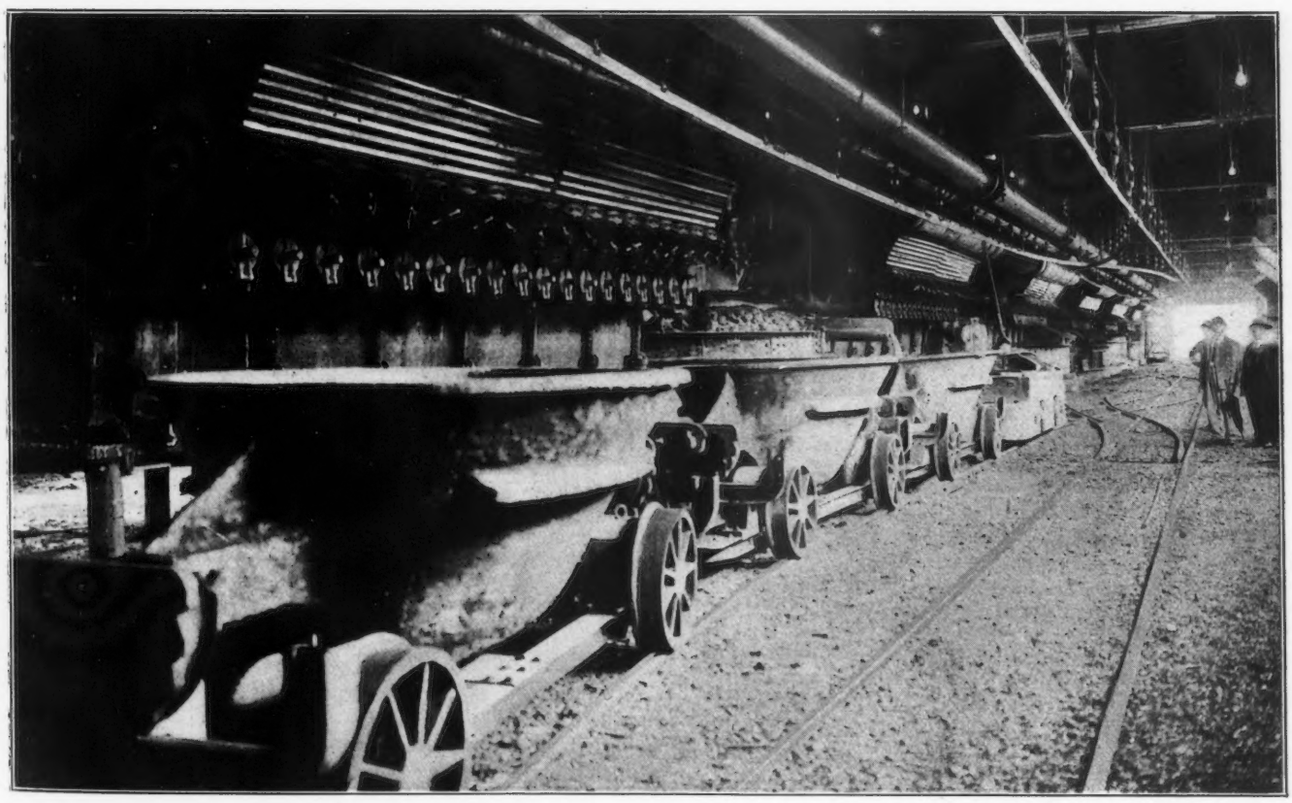


CONVERTER DEPARTMENT IN JULY, 1906, JUST AFTER THE RIOTS, WHEN LABOR WAS SCARCE AND INEFFICIENT

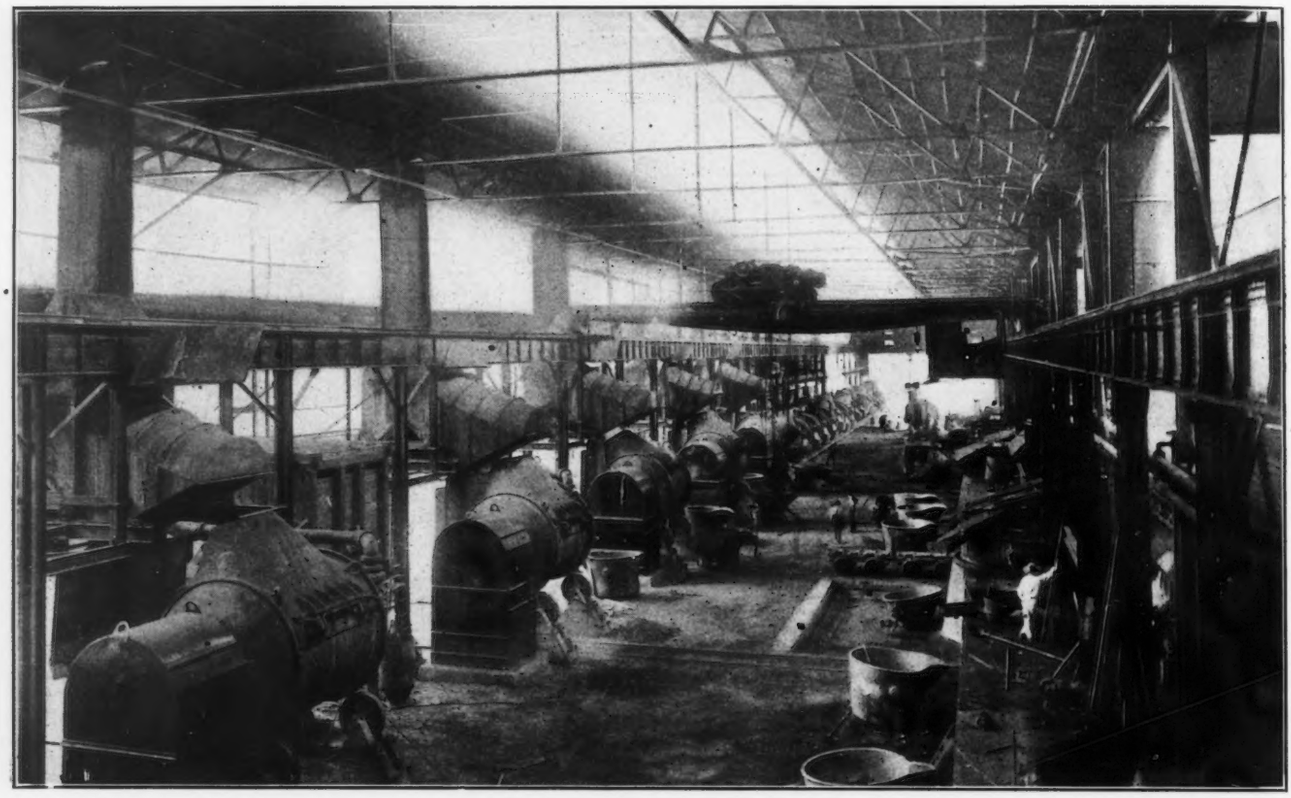
*Superintendent, reduction division, Cananea Consolidated Copper Company, Cananea, Mexico.



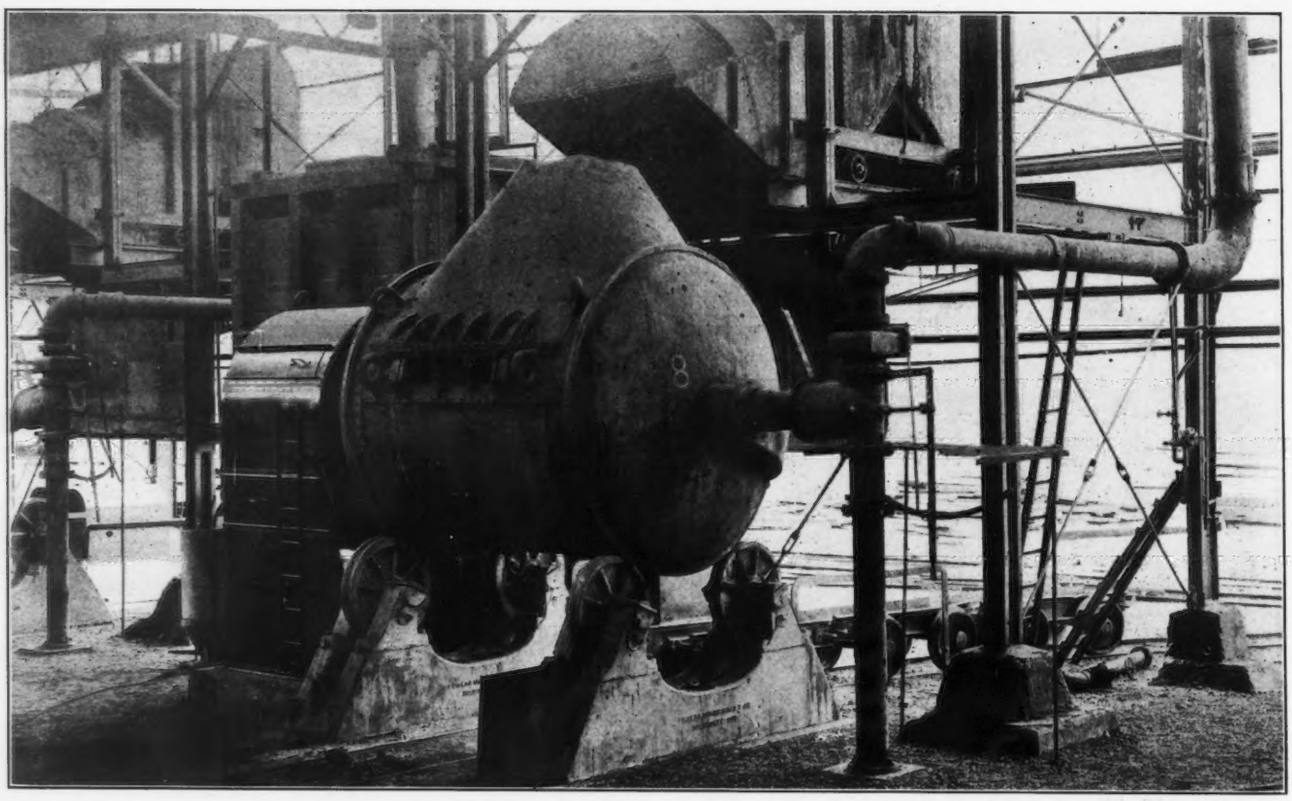
THE NEW FURNACES FROM THE FEED FLOOR, SHOWING FEEDING DEVICE WHICH ELIMINATES HAND LABOR



SLAG SIDE OF THE EIGHT NEW FURNACES ERECTED ON THE SITE OF THE OLD ONES DURING THE LAST YEAR



REMODELED CONVERTER DEPARTMENT, INCLUDING FIVE STANDS AND TWENTY SHELLS, ALL ELECTRICALLY DRIVEN



ONE OF THE NEW CONVERTERS, SHOWING SEVERAL NOVEL FEATURES

Cobar Gold and Copper Field, New South Wales

Oxidized Gold Ores near the Surface Become Refractory and Copper-Bearing with Depth, Presenting Difficulties in Treatment

BY GERARD W. WILLIAMS*

The gold and copper mines of the Cobar district are situated along a north-south line that extends from the township of Cobar to a point about four miles south. The country rock of the district is composed of Silurian slates dipping at an angle that varies from 65 deg. to almost vertical. The ore-shoots occur in a wide lode channel, fairly well defined on the western side, but merging gradually into normal slates on the east. The shoots themselves are usually clearly separated from the western wall, but on the eastern side the ore becomes poor and the shoot becomes indistinguishable from the altered slates forming the ore channel.

There are no fissure veins in the district, the ore-shoot being more or less well defined zones of mineral impregnation in the line of crushed country which forms the ore channel. Speaking generally, from the outcrop of the lodes down to water level, 250 feet, the oxidized ores are schistose in character, and as all copper has been leached out, all mines in this district commenced as gold mines. At present the oxidized ores are almost exhausted, and the gold-mining companies have to consider the treatment of the unoxidized ores, which contain from 0.5 to 1 per cent. copper as chalcopyrite. Throughout the district there appears to be a general increase in the proportion of silica in the orebody in depth. This is noticeably the case in the Cobar gold mine, which adjoins the Great Cobar copper mine and in the Chesney mine. In these mines the percentage of silica ranges from 65 to 80 per cent.

*Mining engineer, Melbourne, Australia.

Great Cobar Copper Mines

The Great Cobar mine, the largest copper mine on the mainland of Australia, is situated at the northern end of the field. There are three well marked shoots of ore in the mine. On the 850-ft. level the size of these shoots is 135 ft. long by 28 ft. wide in the south chute, 485x52 ft. in the central chute and 345x38 ft. in the north chute. The mine is developed to 1050 ft., but the management displays considerable reticence in the matter of divulging to the public the results of development on the bottom level. In this respect the Great Cobar is unique, for it is the only big mine in Australia that is not open to inspection by a competent engineer.

The Great Cobar owns the Chesney mine and the ore from the two mines is smelted in the proportion of three parts Cobar to one part Chesney ore. The following is the percentage composition of the ore from the two mines and the composite ore as smelted:

	Great Cobar.	Chesney.	Mixed Ore.
Silica	23.0	62.0	32.8
Iron	50.0	16.0	42.5
Sulphur	12.7	4.0	11.0
Alumina	7.2	9.4	8.0

The recoveries average 2.5 per cent. copper; 1.1 dwt., gold and 8 dwt. silver per ton of 2240 lb. No working costs are published.

There are three furnaces, 14 ft x 3 ft. 4 in., 15 ft. x 3 ft. 6 in., and 17 ft. x 3 ft. 8 in. at the tuyeres. The furnaces carry from 11 to 12 ft. of charge above the tuyeres and have a capacity of about 4500 tons per week. The first matte averages 24 per cent. copper and this is returned to the furnaces and concentrated up to 40 per cent. This appears to be the economic limit, for with mattes of higher copper value the slag losses become heavy. The mattes are shipped by rail to the company treatment works at Lithgow, 370 miles distant. The consumption of coke is about 9 per cent. ore smelted. The present output averages 380 tons copper per month from 15,700 tons of ore. A large new smelting plant now in course of erection was described in the JOURNAL of May 9, 1908.

The Lithgow plant contains 17 reverberatory furnaces, four of which are used for refining. The electrolytic plant comprises six four-pole dynamos, delivering 1200 amp. at 60 volt, one small 600-amp. 25-volt dynamo and one lighting dynamo for 200 lamps. The six dynamos have a capacity of 150 tons electrolytic copper per week. The temperature of the electrolyte is maintained at 120 deg. F., and in composition varies from 9 to 11 per cent. sulphuric acid and 11 to 14 per cent. copper sulphate. The mud, which carries the gold and silver and about 25 per cent. of copper, is boiled with strong sulphuric acid and after the copper is reduced to about 0.5 per cent. the dried mud is fused with carbonate of soda and nitre. The doré bullion is parted subsequently.

Gold Mines

The two gold mines in the district are the Cobar gold mine and the Occidental gold mine. In both cases the mines have had little trouble in treating the oxidized ore, which is easily crushed and cyanides well; but the unoxidized ore contains about 1 per cent. copper and 18 dwt. of gold, and has so far proved untreatable. Since the ores average fully 75 per cent. silica and since basic ores, except in the Great Cobar mine, are not found in the

DARLING RIVER BETWEEN BROKEN HILL AND COBAR

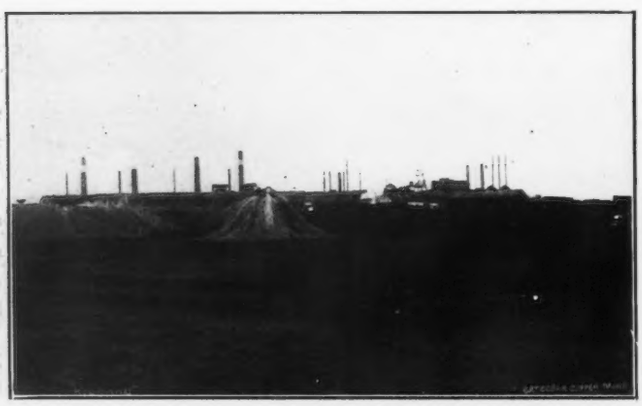
COBAR, NEW SOUTH WALES, AUSTRALIA

district, it will not be possible to smelt; experiments are now being conducted in regard to concentration. The Cobar gold mine erected three Elmore units, but they have thus far not proved a success. The mine is at present closed down. The battery comprises 100 head of 950-lb. Californian stamps.

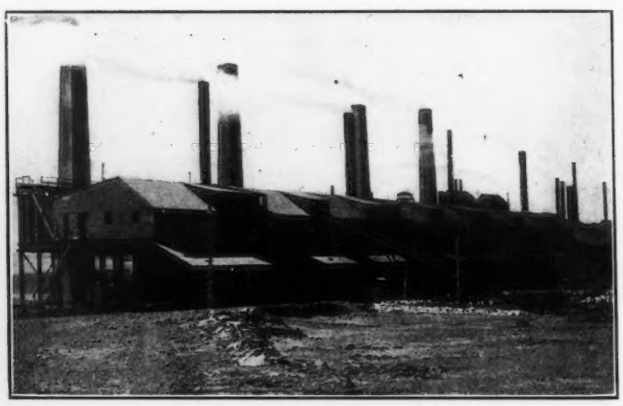
At the Occidental mine the battery consists of forty 800-lb. stamps and twenty 670-lb. stamps. A duty of 2.75 tons is maintained through a 200-mesh punched screen with 85 drops per minute, 8-in. drop and flush discharge. The mill works at surprisingly low costs, considering its antique design and methods, milling costs being 55c. per ton of 2000 lb. The sands and slimes average 2 dwt. 18 grains and the residues 16 grains. The slimes are treated by the Moore filter press which does extremely good work. Slime treatment costs 80c., including 12c. royalty. The sand treatment cost 70c. per ton. The total costs average $2.25; the value of the ore averages $3.84 per ton.

The Cobar district is one of the oldest mining camps in the State, the big mine having been pegged in 1869. The Great Cobar has turned out about 65,000 tons of copper to date, but has been frequently closed down since it was first opened up as a gold mine in 1870. The district is situated about 460 miles from Sydney in the midst of drought-stricken red-soil plains which support but scanty timber. The whole country, from Cobar to Broken Hill and thence through the South Australian "back country" and across the central deserts to the Westralian goldfields, is desert arid country. The rainfall varies from 10 in. to nothing at all and evaporation from shallow dams averages 8 ft. per annum. Before the coming of the rabbit plague the Cobar-Broken Hill country was a great grazing center, but the rabbit has eaten out the very grass roots, killed the young scrub by eating off the bark and left the country almost desert.

Absence of permanent water forms the chief drawback to prospecting. The mineral wealth of the country lying back toward the center of the continent is unquestionable, but with water holes hundreds of miles apart, and uncertain at that, prospecting is a distinctly hazardous occupation. Small parties of men inadequately provided with camels simply court disaster if they venture into the interior.



GREAT COBAR COPPER MINE



GREAT COBAR SMELTERIES

Transvaal Mining Notes

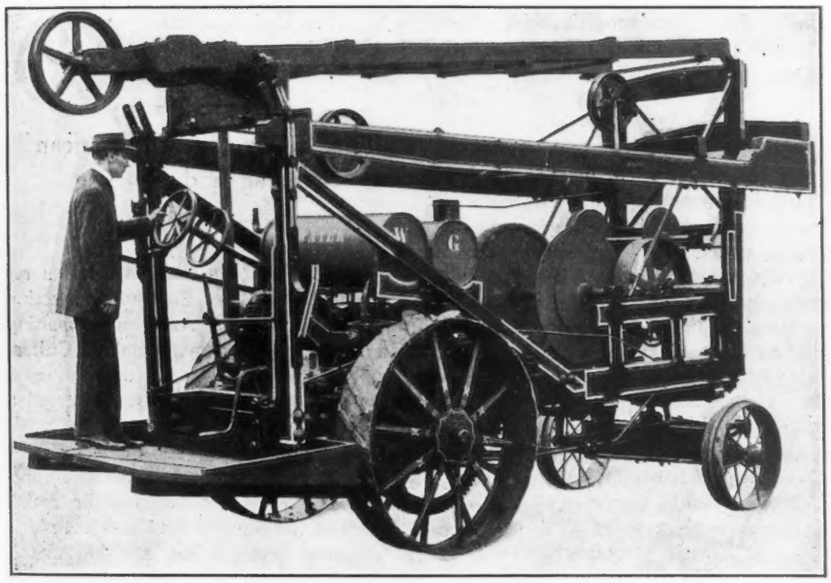
SPECIAL CORRESPONDENCE

At the present moment the attitude of the Transvaal government is being definitely revealed in regard to divers problems of industrial regulation. The new gold law and the base metals bill have been frequently discussed, and it is clear that the main features of the Ministry's draft will stand in spite of real and weighty objections raised by the opposition. A publication of special importance to the Rand has appeared during the week in the report of a select committee formed to deliberate upon the eight-hours bill. It is clear that no objectionable regulations will be forced upon the mines in regard to hours of work, until the whole circumstances of the case have been investigated. The majority report contends that the bill enforcing the eight-hour maximum, would produce a dislocation of industry and business, for which no satisfactory reason has been adduced; and that the present conditions of employment in the Transvaal are such as not to call for remedial legislation. At the same time the unhealthy nature of underground work, even when the utmost precautions are taken to improve hygienic conditions is considered a factor prompting the institution of special inquiry into this issue of the question. The recommendation is made that investigations should be directed toward the following points: (1) As to the hours of work underground upon the different mines; (2) as to whether the large body of underground employees desire any change, and if so, in what direction; (3) how far such limitation as is proposed by the bill could be made practicable; (4) as to the advisability of working two shifts in the day, the remaining period being utilized for the purpose of blasting and cleaning the mines; (5) to what extent the whole question is governed by the use of native labor, and whether it is practicable or economical to apply a limitation of hours of work to the colored laborer. The native appears as a complicating feature in the case, for the labor leaders are strong in their demands that no limitation should be applied to the whites unless affecting the blacks, who might otherwise gain in value in those fields of work where competition may be held to exist. No humanitarian arguments can be advanced in favor of an eight-hour shift for the native, whose spells of continuous service are generally so brief. As for the true wish of the underground worker, for whom a reduction of time would necessarily involve a reduction of wages, it is morally certain that the great majority would oppose the restriction. The contractors would certainly speak for the perpetuation of present conditions, while the advantage to be gained by the day's-pay miner would not be sufficient compensation for the reduction of pay. His hardest work in the day comes at the beginning of the shift, when he has to see that his stope, hanging and faces are safe, and to get his boys to work to best advantage, and at the end, when he is signing tickets, charging up his holes, and blasting. Cut down his time and the reduction only affects the intermediate period of comparative idleness, while the worries of the rush at start and finish of the shift would be more acute than before. The labor leaders have approached the government by deputation in regard to several matters of reform of this character, and while evincing diplomatic sympathy, the ministerial powers are clearly not to be moved to any revolutionary legislation precipitately.

During the six months ended Dec. 31, 1907, there were 100 fatal and 287 non-fatal accidents in the coal mines of Illinois. Of the men killed 51 were miners.

Keystone Gasolene-driven Drills

The traction-drilling machine, shown in the accompanying illustration, embodies a new application of gasolene drive to churn drilling, which the manufacturers, the Keystone Driller Company, Beaver Falls, Penn., believe to approach as nearly as possible the almost ideal conditions found in the steam-driven machine. The steam engine possesses several advantages as the prime mover for drilling: it can be reversed at will to run in either direction; it is capable of the finest adjustment of speed to suit the drop of the drill and the depth of the well; and the volume of power remains almost constant, under command of the throttle, at any required speed. To meet these conditions with a gasolene motor, at the same time retaining the advantages of the internal-combustion engine, requires the production of an entirely new type of engine, or the development of an unusually effective method of transmission and control. In this machine a graduated, reversible, friction-transmission device is employed, the motor running at constant speed in one direction.



KEYSTONE NO. 3 TRACTION, GASOLENE-DRIVEN DRILLER

The transmission device consists of a combination friction-driving disk and flywheel on the motor and a driven wheel, which may be shifted on the transverse transmission shaft, to engage any part of the face of the friction disk. The transverse shaft has hardened-steel ball bearings, and bears a belt pulley for driving the drilling mechanism at one end and at the other the traction-driving gear. The friction disk on the flywheel of the engine has a hardwood filling, inserted "on the end grain," and arranged to wear down 2 in. before requiring renewal. The driven wheel is arranged to slide entirely across the face of the driving disk, and in that way a speed graduation from "high-speed ahead" through zero to "high-speed reverse," is obtained by shifting the wheel from right to left. The position of the driven wheel is controlled by a lever and hand wheel at each end of the machine.

The engine employed is of the two-cylinder opposed type, fitted with fly-ball throttling ignition, battery and magneto. The machine carries two 40-gal. galvanized-iron tanks placed directly above the motor, one for gasolene and the other for cooling water; 40 gal. of gasolene is sufficient to run the engine under ordinary load for 30 hours.

To supply blast for the forge used in dressing drill bits, a rotary blower is supplied with the machine. It is driven from a friction contact with the flywheel of the engine. The air is carried to a forge upon the ground by means of a length of blast hose.

The machines, like the steam drillers made by the same firm, are supplied either with or without traction mechanism. On the traction type, hand levers run to the driver's seat at the rear of the machine. The machine as a whole weighs about 2000 lb. less than the steam machine of the same capacity, and since there is very little fuel and water to carry, the traction machine is more convenient than the corresponding steam driller.

The drilling mechanism and the arrangements for handling the derrick and the drill and sand pump lines are the same as those of the well known steam type. All the tools, derrick, etc., are carried upon the machine. Provision is also made for attaching a trailer or tender wagon in which may be carried fuel and water for several days, additional equipment of pipe, camping outfit, provisions, etc. The tractive force is sufficient to haul several trailers.

An Important Rhodesian Mine

SPECIAL CORRESPONDENCE

The Globe & Phœnix mine is the deepest quartz mine in Rhodesia, the shaft having reached 2300 ft. An interim report for the half-year ending June 30, 1908, just issued, is, on the whole, of an encouraging nature. The ore reserves have been increased since Dec. 31, 1907, from 106,155 tons averaging 11.1 dwt. to 122,408 tons averaging 12.29 dwt. The company originally worked two mines, but the Globe mine has been abandoned, and all ore now comes from the Phœnix mine. There is a mill of 40 stamps with sands and slimes cyanide plant. For the six months 37,546 tons were milled at a cost of $6.46, a reduction in working costs of 27.7c. per ton having been made as compared with the figures of 1907. Included in working costs is in both periods a charge of $0.96 per ton for mine development redemption. The gross profit for the six months, excluding depreciation and London office expenses, was £28,475. Since the commencement of milling operations in 1900 the mines have produced gold to the value of £1,394,650, from which a gross profit—exclusive of head office expenses and depreciation—of £591,019 has been realized.

Some trouble has been met with in the treatment of the ore, owing to increasing quantities of antimony, which has the effect of increasing the consumption of cyanide and chemicals and gives a poorer extraction. To meet this difficulty a sorting plant is being put up, by the use of which it is hoped that the extraction may be improved, and that the antimony may be turned to account.

The vein at the bottom of the mine is disturbed by a dike, and there appears to be some uncertainty whether the values will continue in depth. On this important point the following paragraph from the consulting engineer's report may be quoted: "Development during the six months under review must be considered encouraging, as although the 13th and 14th levels gave average results, the 15th levels shows substantial improvement; this, however, is somewhat discounted by the more recent results at the 16th level, as although the first work gave great encouragement, both laterally and in depth, the drive north is, for the time being, disappointing, and it will take some months' prospecting to prove the effect of the dike met with in the shaft, although the reef appears to be going down."

The dividend for the year 1907 was 3s. 6d. per share on an issued capital of £200,000 in £1 shares. For the current year two interim dividends of 1s. each have been declared. The new sorting plant is expected to be in working order before the end of the year.

The Rare Metals, II—Columbium

By Charles Baskerville*

Columbium, or niobium, is a rare acid-forming element which resembles tantalum, with which it is associated. Its minerals are abundant in pegmatite veins.

COLUMBIUM MINERALS.

	Columbic Acid Content
Columbite (niobite), iron columbate	26–78%
Manganocolumbite, manganiferous columbite	30–57%
Tantalite, iron tantalate	3–40%
Stibiotantalite, antimony tantalo-columbate (?)	7– 8%
Yttrotantalite, a tantalo-columbate of yttrium, iron, etc.	12–13%
Pyrochlore, chiefly a columbate of the cerium metals	47–58%
Fergusonite, essentially a metacolumbate of yttrium, etc.	14–46%
Hatchettolite, a tantalo-columbate of uranium	30%
Samarskite, a tantalo-columbate of yttrium, uranium, etc.	37–56%
Wöhlerite, a silico-zirconate of columbium, calcium, etc.	11–15%
Branzilite, a new mineral accompanying monazite, etc	....
Yttroilmenite, a variety of yttrotantalite	12%
Nohlite, a variety of samarskite	50–51%
Vietinghofite, a ferruginous variety of samarskite	51%
Hielmite, a stannotantalate and columbate of yttrium, etc.	4–17%
Euxenite, a columbate and titanate of yttrium, etc	18–35%
Aeschynite, a columbate and titanate of the cerium metals	32–33%
Polymignite, a columbate and titanate of the cerium metals	12%
Polycrase, a columbate and titanate of yttrium, etc.	19–25%
Arrhenite, a heterogeneous decomposition-product	2– 3%
Blomstrandite, a tantalo-columbate of uranium, etc	....
Rogersite, a columbate of yttrium, etc.	18–20%
Koppite, a pyrocolumbate of cerium, calcium, etc.	62%
Haddamite, a mineral related to microlite	....
Perowskite, calcium titanate	....
Pyrrite, or pyrrhite, a columbate related to pyrochlore	....
Sipylite, chiefly a columbate of erbium	47%
Tapiolite, a tantalate and columbate of iron	11%
Microlite, essentially a calcium pyrotantalate	7– 8%
Skogbölite, a nearly pure iron tantalate	3–40%
Mossite, a tantalo-columbate of iron	41%
Annerödite, a pyrocolumbate of uranium and yttrium	48%
Lavenite, a silicate, tantalate, and zirconate of manganese, etc	0– 5%
Dysanalyte, a titano-columbate of calcium and iron	0–23%
Eucolite, a complex silicate of uncertain composition	0– 4%

The important columbiferous minerals are columbite, pyrochlore, fergusonite, and hatchettolite. Columbium is used in the manufacture of filaments for incandescent lamps and mantles for incandescent gas lights. Except for a small amount used in experimental investigations, all the columbium minerals are exported.

There is no strong demand for columbium at present.

Columbite

Columbite occurs in iron-black, grayish and brownish black, short prismatic crystals; also in groups of parallel crystals, and massive. Columbite grades into tantalite, and the iron and manganese contents vary widely. Tin and tungsten are present but generally in small amount. It is found in Maine, New Hampshire, Massachusetts, Connecticut, New York, Virginia, North Carolina, Colorado, South Dakota and California. Columbite is a brittle mineral, having a hardness of 6, and a specific gravity of 5.3-7.3. Its luster is generally submetallic, but may be very brilliant. The streak is dark red to black.

Columbite is infusible before the blowpipe, and is insoluble in acids. When the finely powdered mineral is decomposed by fusion with caustic potash, and treated with hydrochloric and sulphuric acids, it gives a blue color upon the addition of metallic zinc; this color is more permanent than that produced by tantalite (q.v.). The variety of columbite from Haddam, Conn., is decomposed in part when the pulverized mineral is evaporated to dryness with strong sulphuric acid; its color is rendered lighter, and a strong blue color results from boiling it with hydrochloric acid and metallic zinc.

Columbite dissolves in borax to a bead colored by iron; this bead may be made opaque by flaming after saturation. With salt of phosphorus, columbite behaves like tantalite free from tungstic acid. With soda and niter it gives a manganese reaction.

Pyrochlore

Pyrochlore is generally found in octahedrons, but also in irregular grains embedded in elaeolite-syenite. Its color is brown, dark reddish or black, and the luster is vitreous. The specific gravity is about 4.3, and the hardness is 5-5.5. It is brittle, and the fracture is conchoidal. The streak is light brown. Pyrochlore is found in Norway, and near Miask in the Urals; it is said to occur in syenite on Pike's Peak, Colorado. Before the blowpipe, pyrochlore is infusible, but assumes a yellow color and colors the flame reddish yellow. When ignited, it glows like gadolinite. With borax and salts of phosphorus it gives a light green bead in both the oxidizing and the reducing flames; this bead becomes colorless on cooling. It is decomposed by concentrated sulphuric acid. All varieties are decomposed by fusing with potassium disulphate. Most varieties are sufficiently decomposed by hydrochloric acid to give a blue color when the concentrated solution is boiled with tin; this color disappears upon dilution of the solution.

Hatchettolite

This mineral occurs associated with samarskite in the mica mines of Mitchell county, N. C. It is found in octahedrons of a yellowish brown color and resinous luster. The hardness is 5, and the specific gravity is 4.77-4.90. It is brittle, and the fracture is subconchoidal.

In its pyrognostic deportment, hatchettolite resembles pyrochlore. However, it contains from 15 to 16 per cent. UO_3, and may thus be distinguished from pyrochlore.

Fergusonite

Fergusonite occurs at Rockport, Mass., in granite, associated with zircon near Storeville, South Carolina, and associated with cyrtolite, thorogummite, and magnetite in Llano county, Texas. It also occurs in Burke county, Rutherford county and Mitchell county, North Carolina, and on the allanite of Amelia Court House, Virginia. It is a brittle mineral, having a brownish black color, and externally dull luster. The hardness is 5.5-6, and the specific gravity is 5.8. Its streak is pale brown.

Fergusonite is infusible before the blowpipe, but on charcoal its color changes to a pale yellow. It dissolves with difficulty in borax, giving a yellow bead while hot, the insoluble portion being white; the saturated bead is yellowish red, and may be rendered opaque by flaming. It is slowly dissolved by salt of phosphorus, and gives a yellow bead in the oxidizing flame and a colorless bead in the reducing flame. It is decomposed by soda, leaving a red colored slag. A white residue results from the evaporation with sulphuric acid; when treated with hydrochloric acid and metallic zinc, this residue yields a bluish green color.

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The Policy of the American Smelting and Refining Company

There having been much discussion recently in the press of Colorado respecting the attitude of the American Smelting and Refining Company, Franklin Guiterman, general manager of the Colorado department of that company, addressed a letter to the public, explaining the position of the company, an important part of which is the admission that the company has lent its influence to the maintenance of the price of lead and has aided in creating better prices for that metal. Omitting certain parts relating solely to local politics, Mr. Guiterman's letter is as follows:

Treatment Given the Producers

Much has been said as to the enormous dividends paid by the American Smelting and Refining Company in the carrying on of its business and the argument has been made that the paying of such dividends carries with it the just conclusion that the mining operators have not been fairly dealt with by the company and that in order to pay such dividends extortionate smelting charges have been and continue to be levied. Leaving out of consideration entirely the relationship of the American Smelting and Refining Company to ore producers in States other than Colorado, the pertinent question presents itself, how has this company treated the Colorado ore producers, and to what extent is it entitled to their respect and confidence?

Mining Districts of Colorado

Primarily it may be stated that since

the discovery of Cripple Creek, prospecting in Colorado has practically ceased and the mining of ores in this State has been confined to the camps which were in existence when Cripple Creek was discovered. The camps which produce ore in this State may be tabulated as follows: The Leadville district; Aspen district; Cripple Creek district; Creede district; Rico district; San Juan district; the Park, Clear Creek, Gilpin and Boulder county districts.

In point of tonnage of smelting ore produced these districts would rank in the following order: Leadville, San Juan, Aspen, Cripple Creek, Creede, the monthly tonnages from the other districts having fallen to relatively small quantities.

With the exception of the Cripple Creek district, the ores produced are mainly silver bearing, associated with lead to some extent and with copper to a much less one. It will be recognized, therefore, that with a drop of about 17c. per oz. in the price of silver, the value of the argentiferous ores produced in Colorado has been most unfavorably affected. So much so in fact that a tremendous curtailment in the tonnage output necessarily resulted. Coincident with this heavy decline in the price of silver, came a very great one in the prices of lead and copper, and while the amounts of these metals associated with the silver are not so very large, nevertheless the depreciation in the quotation of these metals has brought a material addition to the great burden the ore producers were already sustaining.

Price of Lead

The American Smelting and Refining Company, large as it is, is and has been utterly without influence on the quotation applying to silver, copper and zinc. It has, as the greatest producer of lead in the United States, lent its sustaining influence to the maintenance of lead prices and to the extent which the company has been able to aid in the creation of better prices for lead, the lead producers of the United States have shared the benefit. The quotations which are sent out as governing the price of lead by the American Smelting and Refining Company are taken from the record of actual sales from week to week as made by the company, and this record is open to the inspection of any ore shipper having business with the company.

The policy of the company with respect to the mining operators in Colorado has been one of consistent reduction in ore treatment charges as fast as improvements were introduced, which in the lowering of operating costs permitted such reductions to be made. In the policy which has actuated the company the salient principle has always been borne in mind to lend aid to such portion of the ore production which absolutely demanded it and to apply treatment charges on such other portions of the ore production which so far from hampering the output would on the contrary stimulate it to its utmost.

Smelting of Ores a Business Different From Any Other

The smelting of ore is a peculiar business and differs in its characteristics from any other industrial business in the country. The industry is one which calls continually for a chemical adjustment of the ore charge and involves at the same time commercial considerations of greatest moment. In nearly every other industrial enterprise the technical execution of the work is referred to the handling of a single raw product or a number of graded raw products very similar in their specific character. In the smelting of precious metal ores, however, most complex problems continually present themselves. For the successful carrying out of the industry it is necessary to deal with a great variety of products and the necessity arises of so regulating the business that the mining output of many sections and districts under extreme fluctuating conditions can be currently taken care of.

In the consideration of the many intricate questions which are continually confronting the custom smelter, that is, one which does not mine but purchases all of its ores from mines owned by others, the company is obligated to take notice of individual ore outputs which it is necessary to secure for the perfection of the general smelting mixture. If it so happens that such outputs cannot be produced under normal treatment charges which might be generally applicable, it becomes necessary to give special inducements to bring out the product, and so it happens that it is not possible in the carrying on of the smelting business to make smelting charges which are regulated by hard and fast rules. On the contrary, it has been and always will be necessary to make such charges as will permit the greatest production of ores from all districts in order that the mining business may be stimulated to its highest degree and the maximum output obtained.

Works Must Be Operated At Nearly Full Capacity.

With the curtailment or cessation of ore production which brings with it concurrently an enforced reduction in smelting operations, smelting expenses quickly rise and the ability of the smelting company to make concessions to any ore producer is quickly restricted.

In the carrying out of this policy uninterruptedly, the basis of calculation has been the operation of all the works of the company under full capacity. Furthermore, the company has not hesitated in the reduction of treatment charges to anticipate the benefits which it was expected would be realized by the introduction of improvements in which large sums have been expended and to give the same in largest measure to the ore producer.

The changing conditions of ore production in the State have brought about a situation which could not satisfactorily be met up to the present. The iron sulphides of which there is a superabundant quantity and which have always commanded the very lowest treatment charges on account of their fluxing character, have steadily declined in value. The silicious ores which are necessary to the smelting of the iron sulphides, have steadily grown less and less in their production although treatment charges have continually been reduced in order to promote the output. Lead ores from Colorado have become a steadily diminishing factor, so that for the smelting of the tonnages which are now available at least 70 per cent. of the necessary lead has to be brought in from outside districts.

Without a very close study and consequent familiarity with these complex conditions, it is not possible for anyone to pass a correct or just judgment on the situation. The ridiculous cry of persons who are unfamiliar with the business, and others who have so little knowledge of it as to formulate weird statistics, that the chief object of the American Smelting and Refining Company is to crush mines out of existence, thereby closing down its own works, seems to be too silly to call for comment. So also may the asinine charges that the American Smelting and Refining Company conducts its business in a dishonest way be dismissed from the consideration of all decent people.

Weighing and Sampling

In the pursuit and carrying out of its business, the company has installed the most perfect apparatus and paraphernalia known in the art of smelting for the correct determination and valuation of ore received by it. The weighing and sampling are conducted under the most rigid methods which make for acuracy, and at all times are the works and methods of the company open to the most searching scrutiny of the ore shippers or representatives who may be delegated by them to look after their interests.

The company is in no wise interested in any public or private samplers, and in giving the concerns the greatest latitude in the sampling and purchasing of ores for its account, it puts them on exactly the same basis of regulation as is the case with shippers who send ores direct to the smelters.

If the ore schedules which are offered to shippers seem to be somewhat complex to the layman, it may be said that they are the result of the evolution from schedules which were introduced in Colorado over a generation ago. To the man, however, who is continually selling ore, and who can easily figure out the resultant value in applying the schedules to his own ore, the rates are not mysterious. The question

finally resolves itself into one of net payment for the metals contained in the ore, and the net value of the ore to the producer after all charges have been met. If the rate is such as will enable him to produce at profit, the ore will be mined. Otherwise it is sure to remain in the ground.

The American Smelting and Refining Company has no monoply in its business. It has no secret processes nor has it a monopoly of the technical and business talent which is necessary to successfully conduct its enterprises. It has no privileges in the matter of secret railway rates, and has constantly exerted its efforts with the railways for the obtaining of minimum freight charges, the benefit of which, when secured, has been given to the ore producer.

The company has been charged with the new crime of employing brains in the conduct of its business. It pleads guilty to this accusation, but in doing so claims that it should and does have a keen recognition of the fact that being entirely dependent on the prosperity of the mining industry, it certainly cannot thrive in its downfall.

The Magnesite Industry of Greece

By F. Meijnan*

There are at present three companies operating magnesite quarries on the island of Euboea. One small company is working a deposit at Hermione on the island of Nauplia. This company exports only crude mineral and has not erected kilns. The Euboea deposits are worked (1) by the Anglo-Greek Company, Ltd., with officers in London, England, the quarries being situated near Limny, on the west coast of the island; (2) by the Société de Travaux Publics et Communaux, Athens, with quarries near Manthoudi on the east coast; (3) by the Société Hellénique de Mines de Magnésite, with offices at Athens, Greece, and Amsterdam, Holland, the quarries being near Pily, on the east coast.

Methods of Working

The Anglo-Greek company mines by open-cut and transports its output, consisting of about 100 tons per day, by a 75-km. aërial tramway, to the port of St. John, near Limny. The product is exported partly as crude mineral and partly as calcined magnesite. The calcining is done in modern bituminous-fired kilns at the company's works in St. John.

The deposits of the Société de Travaux are opened by galleries about 650 m. long. The quarries are connected with the port of Kymassi, near Manthoudi, by a railroad about 2 km. long, over which the daily output of 75 tons is shipped. This product is partly calcined in a modern lignite-fired kiln which works automatically with continuous fire.

The Société Hellénique works its quarries by galleries, and ships the product to Pily by an overhead tramway about 3 km. long. The production amounts to 60 tons per day. Calcining is done in small, open kilns, but an automatic kiln is being built.

Analysis of Magnesite

An average analysis of the magnesite from the three quarries gives $MgCO_3$, 95 per cent.; CaO, 1 to 2 per cent.; SiO_2, 0.5 to 2 per cent.; and some combined water. A complete analysis of crude mineral from the mines of the Société Hellénique is as follows: MgO, 46.28 per cent.; CaO, 0.41; FeO, 0.03; Al_2O_3, 0.07; SiO_2, 2.27; CO_2, 49.85; H_2SO_4, 0.02; P_2O_5, trace; combined H_2O, 1.15.

The price for crude magnesite for 1908-9 is 18 to 20 fr. ($3.47@3.86) per ton in bulk, and for calcines, 72 to 75 fr. ($13.90@14.48) in bags, both f.o.b. steamers at Grecian ports.

A serious attempt is being made to increase the use of magnesite, either dead-burned or in the form of bricks, in the steel industry.

*Société Hellénique de Mines de Magnésite, Athènes, Greece.

Sylvanite, New Mexico

By G. A. Martin*

The latest mining excitement is found in the new camp of Sylvanite, New Mexico. The district is in a barren region in the Big Hatchet mountains in Grant county, in the southwestern part of the Territory. It is 117 miles west of El Paso and is 17 miles from the nearest point on El Paso & Southwestern railroad.

The Ores of Sylvanite

Samples of the ores have been assayed in El Paso, Arizona and Colorado, and all have carried high values. Some have run as high as 216 to 300 oz. of gold to the ton, with considerable silver. There has been much controversy as to the character of the ore, but the assayers and experts generally have come to the conclusion that it is not sylvanite, although they admit that it is very rich. At first the ore was declared to be sylvanite, similar to the ores of the Cripple Creek district, but A. W. Houck, of El Paso, differed from this conclusion, and he has now been sustained by such men as F. C. Earle, manager of the El Paso smelter of the American Smelting and Refining Company; O. A. Critchett, John A. Rice and several other experts of wide experience. Mr. Earle says that he tested the ore for tellurium and ascertained that it contained tellurium but that it gives a strong bismuth reaction. The metal which he tested is of a white substance and he is satisfied that it contains gold, tellurium and bismuth, but he is not yet able to name the mineral. He is inclined to think that it is a telluride of bismuth, carrying gold and that, since tellurium and gold have a strong affinity, part of the gold may be combined chemically and part may be free even within the structure of the telluride of bismuth. Both John A. Rice and O. A. Critchett declare that the ore is not sylvanite, but a tradymite or telluride of bismuth.

*El Paso, Texas.

Reaching the Camp

As already stated, the camp is 17 miles from a railroad, the nearest station being Hachita on El Paso & Southwestern railroad. The trail from this point to Slyvanite can hardly be called a road, and would not be traversed except that it leads to the promised wealth at the gold camp. Thus far all the vehicles in that sparsely settled country have been pressed into service to haul passengers into the camp, and it has been impossible to get any freighting done. Supplies are piled up at the station of Hachita—food and bedding—while miners, prospectors and other inhabitants of the camp suffer from want of food and shiver in the cold at night.

Two automobiles were brought overland from Douglas, Arizona, over 100 miles, and put into the passenger-carrying business. Their owners were operating on the streets of Douglas, but when the gold excitement broke out, they set out across the desert and are now hauling passengers at $5 a head between Hachita and Sylvanite and making more money in a day than they made in a month in Douglas in ordinary traffic. The transportation situation, however, will not be relieved entirely, if the new camp is all that is expected of it, until a branch can be built from the main line of the railroad. Officials of the road have been investigating the situation with the idea of relieving it as soon as the wealth of the camp is definitely determined.

Discovery and Rush to the Camp

The first discovery of gold-bearing ore was made by Sol. Camp, a prospector and old-time Cripple Creek miner. The news spread rapidly, and within 10 days nearly 1000 people had reached the place. There has been much suffering, as the newcomers found no shelter available, and little or nothing to eat, except what they brought with them. Some were thoughtful enough to take some bedding and supplies with them, but others who neglected this and hoped to buy their way, suffered for their folly. The man with money and the man without are on an equal footing in this new camp and each goes hungry if the teamster happens to get a load of passengers at the station and brings them back at $5 a head, instead of the potatoes, flour and bacon for which he left in the morning.

The camp, while made up as all new camps are of men from all sections of the country, men of all characters, inclinations

and callings, is far above the average in the matter of good order, notwithstanding many of the men are hungry half the time, and this is accounted for by the fact that no saloons have been opened. A New Mexico law prevents the opening of a new saloon for a certain period before and after an election and this effectually prevented the sale of liquor in the camp. The owners of the townsite are going to make an effort to keep it out forever and have at least one western mining town without a saloon. Gambling is prohibited entirely by the laws of New Mexico and there is no card playing at Sylvanite.

Present Conditions at the Camp

The townsite has been laid out and all the tents, assay offices, general stores resturants, hotels, and other buildings, none of which is more substantial than wooden sides with a tent covering, are being built on the streets in regular formation, and not helter-skelter as is generally the case in such new towns.

Several tent structures have been erected as "hotels" and accommodate many of the weary inhabitants of the camp, but they are insufficient to give sleeping and boarding accommodations to all the population, even if the food could be secured. And on several occasions the high winds that sweep the dusty plains have laid low these temporary homes, and the occupants have been forced to spend the night with the sky for a covering and snow falling in their faces.

A general store has been established and it is able to dispose of its stock as fast as it can be brought in—everything from a potato to a prospector's pick or a zinc bucket selling at once and having several bidders. The only worry of the men operating the store is that they cannot import their stock as fast as they can sell it.

The camp is full of people anxious to make money while the excitement is at its hight. Carpenters are getting $25 a day and sign painters get almost any price they ask for painting signs. An adventurous newspaper man, Newton Trenham, has gone into the camp with a press and a case of type and is issuing the *Sylvanite Sun*. His advertising columns contain the cards of the "business men" of the new town. Already there are two lawyers busy preparing legal papers in the town of Sylvanite, and a doctor and a dentist have set up offices in tents.

It is a conglomerate collection of men from all parts of the world—wealthy men, poor men, men whose past is closed, men who have made and lost fortunes in mines and hope at least to recoup their losses in this new camp, men who are merely after day labor at the big wages that always prevail in a new camp, and men who are there to live by their wits, or buy their way for small sums into fortunes, all helping to form the cosmopolitan population. While many of the newcomers are men with money, anxious to take bonds, leases and options on properties already staked out, there are others who are flocking in without a cent, hoping to strike it rich in some new locality, or failing, to get work as day laborers in the mines of others more fortunate. Owing to the inaccessibility of the camp, however, and the consequent difficulty in getting freight from the railroad, there are no tools with which to work and the men arriving without money are in sore straits and will become a burden upon the camp if they are not sent out. The railroad has issued a circular warning people to keep away, unless they are well supplied with money.

Incidents of the Camp

There is no water at Sylvanite. Several miles away there are several springs, but the discharge of water is small and is at present barely sufficient to supply the needs of the camp for cooking and drinking purposes; it is transported on burros and sold at $1 a gallon. Fuel is even harder to get than water and most of it is coal, brought 17 miles on muleback from the railroad.

While all the claims for miles around the location of the new town have been taken up, the rush of the gold hunters is not slackening. It is not possible now to obtain claims except by purchase.

The new camp has led to many unique occupations for people anxious to make money. Mrs. Laura B. Parker has become a stage driver, hauling passengers between Hachita and the camp, and has also opened a restaurant in the camp. Hers is one of the places where there is always sufficient food for as many as her cook can serve, for on her regular trips to and from the train, she hauls her provisions. She purchased her outfit in El Paso and went to the scene of the excitement in the early stages of the camp, spending her last cent for her venture.

Future of the Camp

That experts have every faith in the camp is best shown by the manner in which capitalists are putting money into it. As an example: J. M. Cunningham, of the Bank of Bisbee, has taken an option on six claims for $60,000 and has paid down $6000 to bind the deal. He was offered $100,000 for the same properties on the same terms in an hour after he had taken the option, but refused. Other such transfers are being made daily, and an official of the United States land office has set up an office in a temporary structure in the new town, to handle the papers, and is working night and day.

The discover, Sol. Camp, followed placer workings in the valley below, where claims were staked out years ago. He worked at these placers some time before prospecting in the mountains. So far as indications go at present, some rich mines may be found; but most of those who go to the camp will leave it poorer than when they went in. Everything is still too new to venture predictions as to future permanence.

Electric Furnaces in Germany

A report from United States Consul Thomas H. Norton, of Chemnitz, says that hitherto electric furnaces in Germany have been used chiefly for the treatment of small quantities, but now leading works are beginning to employ them on an extensive scale for handling large quantities of metal. At the close of 1907 one of the most important steel works in the Empire engaged in the production of cast steel for gears, as well as of the softer varieties of malleable cast steel for automobile construction and for minor machine parts, decided to replace its battery of crucible furnaces by a large electric furnace. The main cause for the change was the desire to lessen the cost of fusion, while not lowering the quality of the steel, but improving it, if possible.

The old equipment consisted of 32 furnaces, each containing 6 crucibles, with a capacity of 77 lb. They are replaced by a single electric furnace of 250 h.p., capable of holding a charge of a metric ton. A duplicate furnace is likewise installed and kept as a reserve for emergencies.

Electricity is supplied from the large works of a company near Cologne, which furnishes a three-phase current of 5200 volts to quite a large territory near the Rhine for both power and illumination. Alterations in the current intensity are so slight that connection is made directly, without the interposition of a regulator, between the furnace and the transforming station. At the latter a three-phase rotary current, reduced to a tension of 110 volts, is supplied.

The production of cast steel in this furnace has been carried on since the beginning of 1908 without interruption, and with such success that the results are well worth attention.

The main product of the furnace has been cast steel, containing about 0.06 per cent. phosphorus, 0.03 per cent. sulphur, and from 0.08 to 0.18 per cent. carbon. Occasionally charges of tool steel have been cast, containing from 0.7 to 1.3 per cent. of carbon, with and without the addition of nickel, chromium, or tungsten. The material employed is ordinarily cuttings, turnings, and other wrought-iron scrap, costing from $14.28 to $15.47 per metric ton. A fusion, including the refining, lasts about five hours and involves a consumption of about 900 kilowatt hours for 1 metric ton of cast steel. The entire charge of 1 ton is poured at once. When the furnace is kept in continual use the magnesite lining lasts for about 70 operations, or 20 to 25 days. A stoppage of five days is required for each renewal, but during this period the reserve furnace is employed.

The Cost of Longwall in England

Details and Dimensions of the System. Division of Labor, and Wages Paid. Method of Shooting down Stone and Loading out Coal

BY GEORGE R. DIXON

In the JOURNAL of June 6, I described some features in the longwall system of working coal. At the close of my article I said that longwall coal-cutting machines of both the disk and the bar types are used to a great extent, and also face conveyers. The benefits a manager hopes to derive from the introduction of coal-cutting machinery are understood by readers of the JOURNAL, so it is only necessary to state that the important items are: Increased output per person, and decreased cost per ton of coal produced.

On a further introduction of machinery in the shape of face conveyers, one looks for the above benefits to be accentuated. Mine owners and managers are shy in publishing data with regard to working costs. This is, I suppose, natural. In the first place, it is hardly likely that a man will spend money in experimenting, and then publish broadcast the information thus dearly bought. Again, this information may get into the hands of the officials of the miner's union, when it would be used in a way that, to say the least, would not be beneficial to the colliery owner.

Information from one mine manager to another may be given in a brief way. I say beware of such information. Incomplete information is worse than none. I ask mine superintendents if they have not often had to show managers where they were deceiving themselves.

In all branches of mining, careful abstracting of costs is essential. In coal mining, comparison between different methods of working must be done carefully, and with due appreciation of all the influencing factors. Every phase of a question cannot be reduced to figures. Great caution must be exercised before pronouncing a new method an improvement on the old, especially if the new method involves the laying out of a large sum of money on machinery. We all know that failing of the mining engineer, which demands that a scheme shall be an engineering success, without consideration for the pockets of the owners. The reply as to whether the application of, say, coal-cutting machines pays, "Well, we started with one, and we now have 10," may be all right, but I should be inclined to treat it with suspicion.

I have had considerable experience in machine mining, and I propose putting forward some considerations, which I hope will help some readers of the JOURNAL. Obviously I cannot publish actual working costs. I propose treating the subject in such a way that I can be checked in my calculations by men of experience.

In this article I will explain the division of labor in longwall working practiced in the north of England. A knowledge thus gained will perhaps help to appreciate the differences brought about by the introduction of mechanical coal cutters, which I will describe in a second article. In a third article I will describe face conveyers combined with coal-cutting machines.

AVERAGE PAY OF MINERS

In this article I propose dealing only with the work in the face of three districts. The total breadth of coal is 400 yd. The thickness of the seam is 2 ft. 10 in. The price per ton for hewing and filling on this longwall face is 62c. In whole places, or places out of the influence of the roof weighting, 68c. per ton is paid.

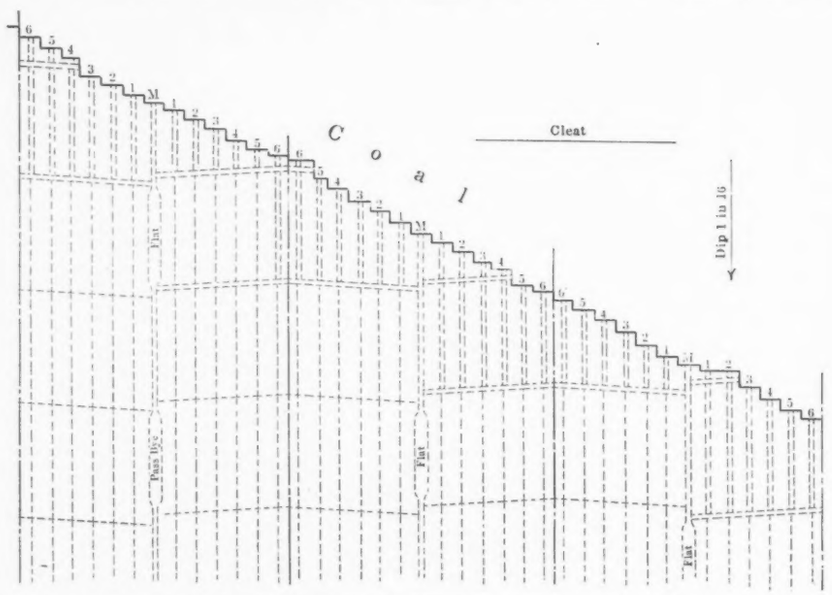

FIG. 1. SHOWING HOW A CONTINUOUS FACE MAY BE KEPT

There are 13 gateways in each district, or 39 gateways in all. To make provision for accidents, let us allow a spare place on each side of the district, or in any one shift we will only have men in 11 gateways. There will then be 33 gateways going out of the total 39. Two hewers can be placed in each gateway, and there will be two shifts of hewers each day. Therefore, 132 hewers can be placed in the 400-yd. breadth. Twelve or thirteen per cent. of these hewers will be absent for various reasons. Let us reckon on getting an average of 115 at work. We will allow $1.92 per shift as the average wage. Remember that they are paid at the rate of 62c. per ton. The average tons per man must, therefore, be 3.1.

The output will, therefore, be about 350 tons per day. A cubic yard of coal in place equals about 19 cwt.; 350 tons of coal, therefore, equals $\frac{350 \times 20}{19}$, or 368.4 cu.yd. The coal is 2 ft. 10 in., or 0.94 yd. high, and the length of face 400 yd. The area of coal being attacked, therefore (in section), is $400 \times 0.94 = 376$ sq.yd. The average advance of the face in each day equals $\frac{368.4}{376}$, or 0.98 yard.

The fore-shift hewer goes in at 3:30 a.m.; but it will be after 4 o'clock when he gets started to work. He gets coal loose so that when the putter gets in to him at 7:30 or 7:45 a.m., he can commence to fill.

It will be seen that in each gateway there is a loose end and that thus there are always two free faces of coal. The hewer must make a third free face by hewing out some part of the seam, or if circumstances are favorable by hewing out the stone above or below the seam.

METHOD OF WORKING

It is evident from Fig. 2 that the coal face is at right angles to the car road in the center of the gateway. Some managers would insist on this. It will be noticed that such a face forms an angle with the mean face line, with the result that the loose end gets nipped and the coal

is easy to work. Most miners, if left to themselves, would accentuate this condition by keeping their 10-yd. face in such a shape that the angle between the direction of the car road and their face would be less than a right angle.

Referring again to Fig. 2 it will be obvious that the coal from the sides of the 10-yd. gateway must be cast to the center with a shovel, before it can be put in the car. This works against the production of a high percentage of large sized coal.

Shooting Down the Stones

On referring to Fig. 3, it will be seen that the top stone in the car road is not shot down right up to the coal. If some stone is not taken down before the hewer drives further, his difficulties in getting his coal filled will be increased. In justice to the hewer, who is paid on the coal filled away, some regulation must be made to protect him from these difficulties. The work of shooting down the stone, and putting in the packs at the sides of the car roads is usually bargain work. The men engaged at it being paid a price per lineal yard.

If these men fail to keep the face of the stone canch within a specified distance from the coal face, they must pay a fine to the hewer. The fine is applied for each day the hewer works under the unfair conditions.

One such scale is as follows:

Should the distance be 5 ft. . . . . The fine is 24c.
Should the distance exceed 8 ft.. " " " 48c.
Should the distance exceed 11 ft.. " " " 72c.

Again the canch men, when pillaring the stone, may build it too close to the coal for the convenient working by the hewer. In this case, also, a fine is resorted to. If the pack is built nearer to the coal than 4 ft. 6 in., the stonemen are fined 60c.

With regard to the process of putting, or collecting the loaded cars and taking them to the haulage landing, I figure 60 cars per putter a fair average under good conditions, each of the cars containing 9 cwt. of coal. The total number of full cars to be put to the flat would be,

$$\frac{350 \times 20}{9} = 778.$$

The number of putters required would be

$$\frac{778}{60} = 13.$$

Supervision in the Day Shift

The man in charge of the district is called a "deputy." He inspects the places before the men go in, in the morning. He is responsible for the ventilation and safe timbering of the working places, and generally has charge of all hands in his district, subject to the direction of the overman; being in fact the overman's "deputy." There is a deputy for each shift of hewers for each district.

In the 400-yd. face under consideration, the number of deputies required will be 6.

The work of shooting down the stone in the gateways is done at night, as is also all repair work on the roads.

There are roughly two classes of men engaged in the work; first are the stonemen who place and fire shots, and second are the stonemen who rid and pack, with and under the direction of the first class of stonemen.

The pit ceases drawing water at 5 p.m. and all day-shift men come to bank. At 6 p.m. the first class stonemen descend into the mine. They set all breaking-off timber that is required, drill shot holes, and shoot down the stone. The second class stonemen follow, going down at 8 p.m. They proceed to rid the shots, packing the stone under the canch, at either side of the car road, which is thus extended.

Method of Withdrawing the Supports

It is very important when this is being done that props, set as supports for the protection of the hewers, should not be built in. They should be knocked out. If they are allowed to remain, when the coal face has advanced, and the weight of the roof comes to them, they will be broken and will push the pack out into the car road. Moreover the even settlement of the roof will be impossible, and the stone over the car road will be broken, and become a source of danger. If the roof comes down evenly on the packs, all supports can be removed in the car roads some distance back from the face, without any danger of falling rock whatever.

The top stone is shot down so that a 6-ft. plank may be set against the roof; this is so arranged that the total hight from the floor will be 5 ft. 6 in. With a seam 2 ft. 10 in. thick, this means a stone canch 2 feet 8 in. in thickness. The stone shot down is packed, so that the distance between packs is 8 ft. when the roof weight comes on. The hight is soon reduced to 4 ft. and the width between packs to 5 ft.

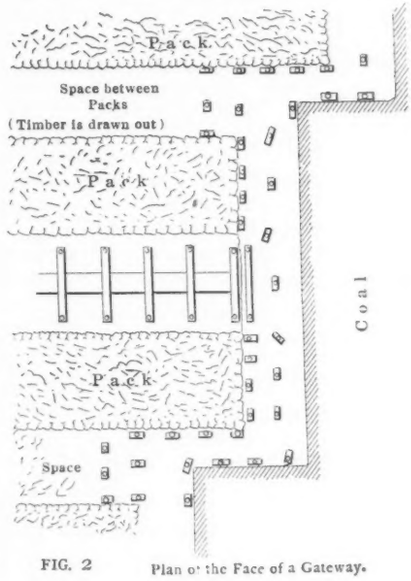

FIG. 2 Plan of the Face of a Gateway.
Scale, 15 ft.=1 in.

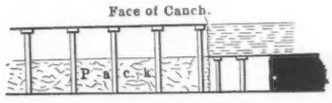

FIG. 3. LONGITUDINAL SECTION OF A GATEWAY

As the average rate of advance of the coal face is 1 yd. per working day, the stone to be shot down in the gateways each night can easily be calculated: One yard in each of 39 gateways equals 39 lin.yd., or 117 ft.; the thickness is 2 ft. 8 in., or 2.67 ft.; the width in each gateway is 6 ft; the cubic feet taken down equals $117 \times 2.67 \times 6$, or 1874 cubic feet.

Cross-heading Dimensions

A cross-heading will cut the gateways off every 50 yd. The yards cut in this cross-heading will be the total length of face, 400 yd., less the added width of the 39 gateways, 78 yd., or 322 yd. Allow 8 yd. additional length, as the cross-headings make a slight angle with the mothergates; this insures a total to cut of 330 yd., or 990 lineal feet.

The cross-headings will be shot 6 ft. higher than the gateways, so the stone canch will be 3 ft. 2 in. thick, or 3.16 ft. The total cubic feet of stone shot down in the cross-headings will amount to $990 \times 6 \times 3.16$, or 18,770 cu.ft. This work is spread over the time required to advance the face 50 yd. It is, therefore, proper to charge one day with $\frac{18,770}{50}$, or 376 cu.ft., as the rate of face advance is 1 yd. per day. The total cubic feet of stone to be shot down each day is 1874×376, or 2250. My experience in this class of work shows that 75 cu.ft. can be got down and packed, for each stoneman's shift. The number of men required equals $\frac{2250}{75}$, or 30. Making the necessary allowance for lost time, 35 men would have to be placed, 11 in each of the three districts. Thirty men attending work each night would follow the canches, and of these, 18 would be first-class stonemen, and 12 would be second-class stonemen.

General Method of Extracting the Coal

In the main gateways or mothergates a second ripping must be made, as all the coal from the district passes down them. In the first instance, the mothergate is used as an ordinary gateway. Soon, like the rest, it is only from 4 ft. to 4 ft. 6 in. high, and 5 ft. between the packs. Two stonemen follow behind making the hight and width required. Where a single car track has to answer, it is shot 6 ft. 6 in. high and 7 ft. wide. Where double car tracks are used, the roadway is shot 6 ft. 6 in. high and 10 ft. wide. Single and double car-track sections alternate, as shown on Fig. 1. On each mothergate, a stone putter is employed to convey the

stone shot down by the back canchmen, to the place where it will be stowed.

A chargeman is appointed to each district to see that the canch work is done properly, and to generally fulfil the same function that the deputy performs in the day shift. He will have the assistance of a third-class stoneman to do repair work on the face roads, or other labor that is required.

SUPERVISION

Suppose the colliery to be producing 1000 tons a day, and costing for underground supervision $9.60. The cost on the face under consideration yielding 350 tons would be, $\frac{40 \times 350}{100}$, or $1.96. We can now arrive at the cost per ton:

COST OF MINING.

Supervision	$3.36
115 hewers, 350 tons at 62c.	219.70
13 putters at $1.38	18.12
6 deputies at $1.68	10.20
3 chargemen at $1.44	4.32
3 3d class stonemen at $1.08	3.24
18 1st class stonemen at $1.92	34.98
12 2d class stonemen at $1.32	14.70
12 back canch stonemen at $1.92	11.64
3 stone putters at $1.20	3.60
179 shifts equal	$323.86

or equal 350 tons at $0.7437 per ton; also, tons per shift in the face equal $\frac{350}{179}$ or 1.95.

The conditions I have in mind are a sound bottom and a good, shale roof. The shot holes in the stone are drilled by twist drills worked by hand. The explosive used is compressed gunpowder, about 4/5 lb. per cubic yard of stone. The conditions as here found are favorable to the introduction of coal-cutting machines.

Use of Electricity in Australian Collieries

BY A. SELWYN BROWN*

Australian colliery proprietors during the past several years have largely increased their power plants in the mines. In many of the larger collieries electricity has taken the place of compressed air as a motive power. The operators now use electric power in pumping, ventilating, hauling and coal-cutting plants. The mines, however, are to a large extent dry, dusty and gaseous, and much trouble has been experienced with the electrical instalments. Every mine using electric power underground possesses interesting records of accidents and minor explosions caused either directly or indirectly by defects in the electrical plants.

On Oct. 1, 1906, an explosion occurred in the Hebburn colliery at Newcastle, N. S. W., which, investigations showed, was caused by a blowout of the trailing cable. As a result of that accident, the mines department framed a more stringent set of rules regulating the use of electricity in coal mines than it had hitherto enforced. In August, 1907, another blowout occurred in the same mine and caused an explosion. Owing to a long series of minor accidents, explosions and pyrotechnic displays around the electric conductors and machinery in this colliery, the miners abandoned work after the explosion in August and petitioned the New South Wales government to compel the owners of the mine to take adequate precautions to secure the safety of the men engaged in underground operations. Many similar complaints regarding the dangerous condition of the electrical plants in other collieries had been received from the miners, so the Government appointed a commission comprising Jno. L. Murray, of the Supreme Court, and engineers representing the Government, and the miners and colliery proprietors' unions, to thoroughly investigate the circumstances of the employment of electricity in coal mines and make suggestions relative to the prevention of accidents through defective installations.

A COMMISSION TO INVESTIGATE CONDITIONS

The commission commenced its investigations last October. Its work was thorough. All the principal coal-mining districts were visited and a large amount of evidence and statistics bearing upon the use, benefits and dangers of electric plants was collected and collated. In addition to its sittings in the courts in the various coal-mining districts visited with the purpose of collecting evidence from mining officials and miners, the members of the commission carried out many valuable experiments and tested a number of electric coal-mining plants at the Government's electrical power plant and laboratories at Ultimo, Sydney, and at several of the mines.

The commission forwarded to the Government an interim report early in January. In this it was stated that the value of electricity for mining purposes could not be doubted, but its use is accompanied by serious dangers when carelessly employed underground in coal mines. These dangers, however, can be greatly minimized by adequate precaution if properly used by the mine officials.

The commission found that 33 collieries in New South Wales have complete electrical equipments, with a total capacity in electric output amounting to 2176 kw., or 2917 h.p. These mines employ 1482 electric lamps on the surface and 800 electric lamps underground. Sixteen collieries employ electric coal-cutting machines and about 70 such machines are now in use. Nineteen collieries use electric pumping plants underground and employ 10 electrically driven ventilating fans in the workings.

These plants are all of the low-pressure type that is so popular in Europe and the commission recommends the Government to prohibit the use of any other type.

The principal dangers arising from the operation of the plants were found to be chiefly: (1) shocks, (2) explosions, (3) fire in the workings. The experiments carried out by the commission plainly showed that for portable motors, in connection with which shocks are most likely to be received, only low-pressure currents should be used.

The most probable causes of shocks were found to be:

(1) Leakage, rendering machine bases, covers, or cable armorings "alive," so that any persons touching them receive shocks; and (2) the leaving of "live" portions of the circuit exposed where they are accessible generally to persons who are not acquainted with the electrical risks. Both these matters received the special consideration of the committee which drafted the British rules, and numerous provisions were made guarding against either contingency. During the inspections and inquiries made by the commission many illustrations of the necessity for such precautions were met with.

One of the most frequent causes of shocks from leakage was the lack of proper testing and repair of the trailing cables, in consequence of which the armoring of the moist outer covering would become "alive," and the men whose duty it is to handle these cables would receive shocks. In one mine the proper maintenance of the cable insulation was so entirely disregarded that on a trailing cable which was actually in service during the commission visit, there were a number of places where the insulation and covering were completely broken through, leaving the bare conductor easily visible. The commission considered it advisable to draft a number of new rules relative to the use and regular testing of trailing cables.

Shocks from "live" metal intentionally left exposed are most frequent in connection with low-pressure systems, owing to an exaggerated idea of the harmlessness of the shock. Switches with their conducting parts entirely exposed were found in the main roadways; also in the traveling-roads of one naked-light mine visited, long lengths of cable were seen from which the covering had entirely rotted off, leaving the bare "live" conductor in a position and at a hight where the employees were quite likely to come into contact with it. One of the worst features of such practices is the disrespect for the electrical risks engendered in the minds of general employees who are uninformed in these matters.

The members of the commission gave the matter prominence, as they found a disinclination in some quarters to admit the necessity for guarding bare metal carrying low pressure, and the tendency to practical joking with conductors of low pressure has unfortunately been in evidence more than once.

In carrying on the researches, the British commission's 1904 report, and several American, German and French reports on

*Mining engineer, New York City.

the employment of electricity in coal mines were consulted. The British rules dealing with the causes of fire in coal seams and workings, however, were not found to be sufficiently stringent. Fires are caused chiefly by the overheating of the electric conductors, leaking of currents, fusing of arcs and sparking.

Medium Voltage is Dangerous In Wet Mines

In drawing up its rules the British commission stated that in regard to the restriction of currents employed underground, it considered that at the working face, a reasonable limit would be a medium pressure, not in any case to exceed 650 volts. But in the rest of the mine, if proper precautions are taken, we have no reason to think there would be undue danger in much higher voltages. As for danger from shock, it is in a wet mine nearly as great with a medium voltage as a high one, and bad apparatus is capable, even at low voltages, of causing fires or exploding gas. When once, however, the apparatus is of excellent quality, well installed and completely protected, there seems no reason to apprehend undue danger either in mines or factories from the use of high voltages, and we do not see why in the United Kingdom any more stringent limits should be imposed than have been found necessary on the Continent."

The New South Wales commission, however, has recommended stringent restrictions relative to the strength of currents employed in dangerous working faces. The representatives of the miners' unions on the commission were strongly insistent in their advocacy of the necessity in restricting the voltage used in coal-cutting machines.

Advisability of Electric Conductors In Return Airways

Much attention was given to the discussion of the advisability of placing the electric conductors in the return airways in collieries. But the miners generally opposed this on the grounds that a large amount of the gas evolved in the workings was carried away through these airways and consequently defective conductors would be a continual menace to the safety of the men. The members of the commission could not arrive at a proper solution of this question and it was left open.

In the matter of providing against the presence of gas where portable motors are used at the face for coal-cutting and other purposes, the commission states it has carried the precautionary measures to even greater length than is required by the codes of rules employed in other countries. The rules provide for the frequent examination of all machines at the working faces during the time that the electric power is used for undercutting, with an absolute requirement for the immediate stoppage of the machines and the shutting off of the current in the event of gas being discovered during such examination. This regulation insures that even if the apparatus is accidentally damaged, its use will be so well governed under the conditions the commission has laid down that miners can work with coal-cutting machines at the different collieries where the commission saw them installed, with every reasonable sense of security and safety.

The commission quotes liberally from the British commission's report, issued in 1904, and adds that it agrees entirely with the salient features of that commission's conclusions. Although the rules the commission proposes include numerous departures from the British, it is mainly in precision of detail, as the investigation furnished ample evidence that definiteness in rules is essential to the prevention of bad work.

Results of the Investigation

As a result of its investigations, the commission decided to recommend that the New South Wales Department of Mines adopt a much more stringent set of rules than those now in force. Such rules were drafted by the commission and embodied in its report.

The commission was unanimous in its recommendations that the mine electricians and their assistants should be required to pass an examination which would be something more than of a high academic character, and the opinion is expressed that the present mines electricians can pass this examination. It furthermore recommended that the services of a consulting electrical engineer be secured by the Mines Department, so that inspectors may have the benefit of his advice should necessity arise.

The commission's recommendations agree in most respects, with those made by the Department of Mines' colliery inspectors while engaged in their official duties. It is, therefore, most probable that the regulations for the use of electricity in coal mines, so carefully drafted by the commission, will be adopted by the Government *in toto*. The proper enforcement of the regulations will, doubtless, obviate many of the evils hitherto arising in mines using electric plants underground, and restore public confidence. When such confidence is restored, a great impetus will be given to the employment of electrical plants in Australian coal mines.

Illumination in Mines

By Lucius W. Mayer*

The use of acetylene underground has met with favor throughout all the European mining districts. Tallow candles and oil are still used to a great extent in working places, but the modern form of acetylene gas lamp is largely used by officials.

At Mechernich, Germany, arc lamps without glass globes are used underground, and the result has been favorable. The condition of walls and roof is constantly under clear surveillance. A single lamp illuminates a large area in an efficient manner, and the conditions are much like working on the surface. The cost for operating the arc lamp at Mechernich is given as 24c. per 24 hours.

Smoky Lamps Objectionable

Not alone is it desirable to obviate the use of a smoky material in underground lighting, but the efficiency of the men may be increased, in view of the better light conditions under which they work, to say nothing of the incessant intermissions during working hours, to fill the present form of lamp.

In addition to the acetylene lamps used for carrying in the hand, a large stationary model is made by manufacturers, and may be hung at any point; such lamps weigh about 8 lb., and have a rated lighting effect of 50 c.p.; one charge of acetylene affords 14 to 16 hours' light.

All these lamps work on the same principle, and consist of a lower carbide holder containing no joints, but pressed out of one piece of sheet steel or brass. On this lower vessel is fixed the burner. The upper vessel, the water reservoir, is clamped over the lower vessel, the carbide reservoir, by means of a bridle. The degree of light to be emitted from the burner is regulated by the speed of admission of water from the upper to the lower reservoir.

Carbide cost in England is given at 1/16 penny per hour. In France, the figures given me at Carmaux for consumption in this form of lamp is ½ lb. carbide for 10 hours' burning, the carbide costing 13.5c. per kg. This figures about 6.36c. per pound of carbide, or 0.03c. per hour. Carbide in England, yielding 4.9 cu.ft. of gas per pound of calcium carbide sells for 11.1c. per lb., and in hundredweight lots at 7.09c. per pound.

In England the supply of carbide is imported from Norway, and being very imflammable when coming in contact with water, the steamship and railroad lines hesitate to carry it.

Carbide rated to give 5 ft. of gas is supplied all over the United States by the Union Carbide Company, costing 9c. per lb. in 10-lb. lots, and 5c. per lb. in 100-lb. lots. It is claimed that there is no difficulty with the railroads here in the transportation of this material.

In using these acetylene lamps, they should be cleaned each time they are used, which does not amount to more than seeing that the aperture which permits the water to the carbide reservoir is kept open. The evolution of unconsumed gas when not ignited at the burner is very disagreeable, and it will be found well, when turning off the water supply, to keep the gas lit until it ceases to be evolved; in short, to allow itself to burn out.

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Colliery Notes

The cost of washing coal in England, varies from 4 to 8c. per ton; the washed coal is exhanced in value from 12 to 14c. per ton.

Many miners do much to foul the air in coal mines by burning a cheap quality of oil in their lamps. Much harm is also accomplished by adding coal oil to the sperm or lard oil generally used.

Methane (marsh gas), although generally associated with coal measures, may occur in dangerous quantities in any geological strata. Jets of this gas have been found in iron, silver, lead and salt mines.

Naked lights in a mine may continue burning brightly in an atmosphere that is fatal to life; on the other hand, lights may be completely extinguished in an atmosphere where no immediate danger exists.

An air current at a temperature of 62 deg. F., fully saturated with moisture, requires approximately 7 per cent. more heat units (B.t.u.) than dry air to reach a temperature of 1213 deg. F., which is the point of ignition of firedamp.

Gas rises more rapidly in an atmosphere free from humidity, as is demonstrated by the ascent of chimney smoke on a cold, crisp morning; likewise do gases rise to the roof of the mine and accumulate there in a dry atmosphere.

Investigation shows that boring by rigid iron rods is only practicable to a depth of about 1000 ft.; it is common practice in boring holes only this deep, by the percussion method with rigid rods, to make use of some kind of "free-fall," by which the jar to the column of rods is limited.

A gaseous or dangerous mine atmosphere affects animals more quickly than men. A mouse is affected in about one-twentieth of the time required to produce the same effect on a man. For this reason a mouse carried in a cage serves as an index of the dangerous qualities of a suspected mine atmosphere.

When a fiery mine remains idle a day or two, even though the ventilating current is continued as usual, the dangerous gases soon stratify and accumulate near the roof of rooms and entries. When the mines are working, the travel of men and trips causes the air currents and the gases to thoroughly mix so that no stratification occurs.

The reports of investigation committees in this country, in Australia and in Europe, show that the consensus of opinion favors 650 volts as the maximum current employed for electrical transmission underground, through exposed cables. Any current at a potential of more than 650 volts should be carried by means of a completely insulated cable.

The more cold air forced through a mine in the winter, the drier will the workings become; the more air forced into a mine in the summer, the more moisture will be deposited. In mines with slate roofs, the greatest difficulty in supporting the top occurs during the summer months when the greater humidity in the air causes the slate to slack and drop off.

A ventilating current of 200,000 cu.ft. per min. upon entering a mine and cooling 5 deg. in temperature would deposit in the mine about 2500 gal. of water each 24 hours. This increase in the relative humidity of the ventilating current in summer months is the strongest argument advanced by those who claim that explosions are more likely to occur in winter than in summer.

The Kingston Coal Company has decided upon a system of education, which will enable all of its foreign employees to secure a working knowledge of the English language. A course of study has been devised and competent instructors employed. It is the intention of the company to familiarize the newcomer with the English language by the shortest possible method. The expense incurred through this educational work will be borne by the company.

One of the greatest fuel experts, the late Sir William Siemens, expressed his opinion on the utilization of fuels in the following words: "I am bold enough to go so far as to say that raw coal should not be used as fuel for any purpose whatever, and the first step toward the judicious and economic production of heat is the gas retort or gas producer, in which coal is converted either entirely into gas, or into gas and coke, as is the usage at our ordinary gas works."

In boring a deep well in Galicia, Austria, the time occupied in drawing up and letting down the rods when it was necessary to clean out the hole was recorded by Nelson Boyd as follows:

	Minutes.
Drawing rod,.....	25
Letting down the sand pump by means of the rod	14
Drawing up the sand pump	24
Changing the chisel	3
Letting down the chisel.....	14
Connecting the feed	5
Total.....	85

It has been found advisable at many coal washeries to introduce among the coal, a mineral having a specific gravity slightly less than the heavier dirt particles and slightly greater than the coal; this mineral acts as a filter through which the shale will pass and on the top of which the coal will remain, thus insuring a more perfect separation. Feldspar is an excellent mineral for this purpose, and suitable particles of this substance are placed in the sieves of the jiggers.

The British Colliery Commission, in their report dealing with mine explosions, point out that when mines are sprayed to settle and dampen dust, the excessive humidity in the air injuriously affects the health of the miner. The temperature of many of the English mines ranges from 90 to 95 deg. F., while in this country our mines have an average temperature of 70 to 75 deg. The affect of humidity in the air on our miners would not be anything like as injurious as to the men working in the deeper English mines.

According to Mr. Redmayne, the cost of boring through the coal measurres in the north of England is usually about 30c. per ft. for the first 30 ft., with an increase of 30c. per ft. for every additional 30 ft.; thus if C equals the cost of the bore-hole; a equals the price of the first step; b equals increase in price for each additional step; and n equals number of steps; then by arithmetical progression:

$$C = \frac{n}{2}\left\{2a + (n-1)b\right\},$$

or considering that the bore-hole is 300 ft. deep—

$$C = \frac{10}{2}\left\{\$9 \times 2 + (10-1)\,\$9\right\} = \$495.$$

Recent investigations by Carl Scholtz may be summarized as follows: 1. Explosions occur more frequently in the colder months of the year; the colder the winter the more frequent the explosions. If a certain district has extremely cold weather and other sections of the country are comparatively warm, the latter sections are freer from explosions. 2. Mining fields located in higher altitudes are more productive of explosions than those at lower elevations. 3. The hydrometric condition of the atmosphere has the greatest effect upon the cause of explosions. Mr. Scholz says further: "Every practical mining man knows that the majority of explosions take place between Nov. 1 and March 15. Every mine examiner instinctively feels danger when he enters the mine on a cold, crisp morning."

In prospecting coal seams by boring, the preservation of the cores and the correct description of the strata passed through ranks of considerable importance. The recording of all fossils met with is also desirable, as such records may, in many cases, afford the only true index to the deposits. The most satisfactory method of keeping the cores so that they can be readily examined at intervals is to place them in a shanty built of galvanized iron. At several localities in both Europe and America, when the borings are deep, this house is built about 100 ft. in length, and of sufficient width to allow the cores to be arranged on the ground in a single tier, each length of 100 ft. being separated from the next by match-boarding. The depths from which the cores are obtained should be inserted on them at frequent intervals by means of labels, affixed by some adhesive not affected by damp.

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*Illustrated.

The American Smelting and Refining Company

In the recent political campaign in Colorado the policy of the American Smelting and Refining Company received a good deal of discussion, much of which was nonsensical. However, there was sufficient of rational character to lead Mr. Guiterman, general manager of the Colorado department of the company, to make an official reply, the substance of which, insofar as it concerns matters of interest to our readers, is published elsewhere in this issue. The chief interest in Mr. Guiterman's letter, in our opinion, is the admission that the smelting company has exercised its influence to elevate the price for lead. He does not assert specifically that the company has succeeded in keeping it at a level above that which otherwise would have existed, but the inference is strong that such is the opinion of his company. Obviously, no one can reduce to a numerical statement what might have been if something had not happened, but it is the common opinion of economic students that during the regime of the American Smelting and Refining Company the price for lead has been higher than it would have been if that company had not exercised a successful dominion in the market for a series of years. This was to the great advantage both of the smelting company and the producers of lead ore, and correspondingly at the expense of the consumers of lead products.

With respect to the relations between the smelting company and the ore producers of Colorado in general, Mr. Guiterman summarizes the situation in a lucid way, but his arguments would be more convincing if they were supported by figures. It is a pity that the management of the company cannot make up its mind to be more frank, both with its customers and its stockholders. The stockholders are informed of large profits, but do not know how they are derived and what is the prospect for their continuance, while the customers, i.e., the producers of ore, look upon the same large profits as being to a more or less extent extorted from their pockets.

The chief part of the business of the American Smelting and Refining Company is the smelting of ore. The conditions which make for an increase in the ore supply tend to increase the profits of the company. The company has never stated how much ore it smelts or given any other specific information respecting its business, its annual reports being confined to generalities.

We appreciate the difficulties wrapped around the disclosure of details of its business, and its proper reluctance to disclose the results of speculations in the metals, etc., that might be to the advantage of its competitors, but nevertheless it might be able to give information satisfactory to many interests without in any way injuring its own. Of course, the charge that the smelting company is throttling the mining industry is absurd. Such a policy would be simply hari-kari. Any well advised concern going into the general smelting business expects to realize a profit of $1.50 to $2 per ton of ore smelted; at any lower figure the business would not be attractive, taking all the chances into consideration. The average profit to the American Smelting and Refining Company is probably somewhat higher. In certain districts, like Utah, where there is keen competition, it is probably less; also in districts like Colorado, where it is necessary to be content with a comparatively small profit in order to stimulate the necessary production of ore; in other districts, like Mexico, the ore producers are probably caused to suffer all of the burden that they can bear, especially if they produce the kind of ore that is in excess supply. It is the ability to average these conditions; viz., large profits in one district against small profits in another that contributes largely to the wonderful earning capacity of the company.

The Copper Market

The brilliant rise in copper during the last week has excited great enthusiasm and has led to an old-fashioned boom in the market for the copper stocks. The rise in the value of the metal appears to be legitimate, although assisted by more or less manipulation. The sales of copper during the latter half of October were very large, and most of the producers claim to have sold their expected output for the remainder of the year. However, these claims must be taken with some grains of salt. There has been during the last six months remarkable success in enveloping with mystery the matter of the unsold stock of copper. It is hard to be-

lieve that on Oct. 1, say, there was really no unsold stock of copper in view of what was known to be on hand at the beginning of the year, the slackness of business during much of the first nine months, and the large production. There have been, of course, the regular transactions which go on right along, and there have been some periods of very large sales as in October, but about 100,000,000 lb. per month, or 4,000,000 lb. each business day, must be sold in order to dispose of the production.

The current revival in business reported from many quarters is largely the result of improvement in sentiment, restoration of confidence, since the election. Undoubtedly many orders for goods were held back until after the election, and then came upon the market with a rush. There is no ground for the belief that the actual improvement in business has been in any such ratio, or that we are going to regain quickly the boom that disappeared in 1907. Consequently, we are likely to see a recession in the prices for the metals when the present flush of excitement wears off. Nevertheless, it can be clearly recognized that the improvement in industrial conditions, noticed several months ago, is gaining steadily, although still slowly, and there is reason to expect that in 1909 business will recover its normal activity. An encouraging feature of the present situation is the buying of metals by large manufacturers in anticipation of good business with consumers sooner or later in the coming year.

Low Prices Do Not Always Restrict Production

The recent low prices for some of the metals have brought about conditions that lead to doubt respecting the advantage of modern improvements. It was always expected that a price for zinc ore of under $40 would enormously restrict the production of the Joplin district, but although throughout 1908 the price has been a good deal below that figure, the production has not been greatly restricted, although a large proportion of the important mines and mills has been idle. The explanation is that the production has been kept up by miners who have been working in the old diggings on their own account, and evidently have been able at least to make a living at present prices.

A similar report comes from Malaya, where instead of the decreased output of tin, confidently expected at the beginning of the year, the production has on the contrary been steadily increasing. The decline in the value of tin compelled many of the capitalized European companies, and also many of the large Chinese operators, to suspend production. Here also the explanation is that the miners have gone to work in the old diggings on their own account.

Both in southwestern Missouri and in Malaya mining conditions are exceptional, but nevertheless it is something of a joke that individuals can work by hand where companies are unable to conduct operations upon a large scale. It indicates for one thing how much more efficient is labor when engaged on its own account, and also no doubt the willingness under that condition to be content with smaller earnings.

Pittsburg Coal Trade and Prices

The coal trade of the Pittsburg district this year has shown a falling off of from 25 to 30 per cent. from that of 1907, as nearly as can be ascertained from railroad and other shipping reports. In the river trade, which takes an important part of the coal production of the district, the decrease has been greater, owing to the long drought which has resulted in a stoppage of navigation through a period longer than most rivermen can remember. There has been no "coal-boat rise" in the Ohio since spring, and the territory dependent usually upon Pittsburg river coal has been obliged to draw its supplies by rail from West Virginia, Kentucky and Indiana mines, and in some cases from Alabama. Notwithstanding this loss in demand, our Pittsburg reports have shown that the larger producers have been maintaining prices for coal on the basis of $1.15 per ton for run-of-mine all through the season. This requires explanation.

The contract price for Pittsburg coal depends in large degree on the Lake trade. Prices for the grades shipped up the Lakes are established early in the year, the contracts being usually made in February and March. From that time they are maintained on all contract coal, for the reason that if they are permitted to break, it would be necessary to rebill the coal previously shipped at season price; this would demoralize the market and result in serious losses, besides alienating customers and making trouble when the time for closing contracts for the next season arrives.

An additional reason for holding up contract prices is the effect which a drop would have in Buffalo and other distant markets, in which Pittsburg coal has an advantage in its superior quality and in the insistence of many customers on a supply of this grade, which they prefer from long use and custom. In these markets Pittsburg coal establishes the price for all other grades except Indiana block and a few specially prepared grades. The competition in these markets is very sharp, and a break in Pittsburg prices might have disastrous results.

At the same time it cannot be denied that the Pittsburg market has felt the decline in demand, and the results have been shown in spot sales, though not in contract shipments. Slack coal has sold at very low prices, and sales of run-of-mine for prompt shipments have been made down to $1 and even less. The large shippers have done their best to maintain contract prices, but they have not been able to resist competition on spot orders. The largest producer in the district, which has shown a heavy loss in traffic this year, is urgently endeavoring to secure new business, and is said to be making low rates to get it where possible.

This will explain the apparent steadiness of Pittsburg prices in the face of adverse conditions. Some increase in demand is apparent, but it is very slow so far. A sharper increase for the rail trade and heavy rains for the river trade are needed to revive the market.

IT IS SAID THAT the American Smelting and Refining Company has not achieved the success with the Huntington-Heberlein process which the metallurgists of the smelteries at Tarnowitz, Braubach, Ems, Pertusola, and elsewhere in Europe claim to have obtained. This is probably because the European works treat a larger proportion of lead concentrate and a smaller proportion of silicious ores than has been attempted in this country. At Broken Hill, New South Wales, the process seems to have been an unqualified success. In a recent address, Mr. Delprat, general manager of the Proprietary Company, remarked that out of the 13 furnaces at Port Pirie required 10 years ago to produce 1000 tons of lead per week, at present nine are sufficient to produce 2000 tons, this remarkable progress being due to improvements in roasting, smelting and refining.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Loading Blast Holes

In discussing the loading of holes in the JOURNAL of Nov. 7, 1908, a contributor signing himself "Tom" takes exception to an editorial in the JOURNAL of Oct. 17, 1908, regarding the proper place for the primer in a dynamite charge. Mr. Tom states that if, in a round of holes in a drift, the primer is placed in the top of the hole, there is the certainty of missed holes resulting either from a nearby hole breaking out the collar of another hole and carrying away the primer, or from flying rocks tearing the fuse out of the hole. With this opinion I disagree. The first of these causes is the least important, for if the round of holes in a drift is drilled properly there is little likelihood of the cutting off of a hole; still it is worthy of discussion. While I have known of several blasted-off collars of holes being found in which there still was dynamite, I have yet to learn of one in which there was a detonator in that portion of the charge. In fact, I think that it would be impossible for this to occur, owing to the greater sensitiveness to shock of the detonator. Anyway I am of the opinion that if enough of the collar of any properly loaded hole, whether in a drift, or for that matter in a stope, was "cut off" so that the primer was carried away, the force of this explosion would also cut off or tear out the fuse, were it placed even in the very bottom of the hole; worse still, possibly it might only damage the fuse, and a "hang fire" might result. Anyway I would prefer to go back to a missed hole when the primer is in the top of the hole than in the bottom, for I always feel safer around a missed hole after I have pulled the fuse and cap out of it.

In regard to the possibility of flying rocks jerking the fuse out of a hole, I think that Mr. Tom is unduly apprehensive. All fuse should be coiled up close to the collar of the hole, not only in order to protect the fuse from being struck by flying rocks, but so as to avoid a mistake in the order of spitting the holes. The fuse should not be spit one from another, but from a notched piece of fuse, as otherwise too much fuse is left dangling about. A miner should not entirely rely upon the cutting of the fuse for the proper order of exploding; he must always be prepared to respit a fuse; that takes some time, and if the holes were spit out of their proper order it might spoil the order of the holes' exploding. If the fuse is properly coiled up, there is little danger of flying rock hitting the fuse. Anyway I think that more missed holes are attributed to flying rocks than is warranted. Eight inches of soft tamping on top of the dynamite ought to hold a fuse in the charge. At the Franklin Furnace zinc mines, New Jersey, soft dirt, or fine rock tamping, inclosed in a paper cartridge, is, or at least was, used in tamping the holes. That is, in my opinion, good practice.

The effect of the explosive is considerably lessened if there is any air space intervening between the walls of the hole and the explosive, or in the explosive itself. One great trouble with putting the primer at the bottom of the charge is that when the primer is so placed miners are apt not to consolidate the dynamite sufficiently in the hole, especially in a cold stope where in winter the dynamite often becomes half-frozen before it can be got into a hole. Besides, during the consolidation of the dynamite the fuse is subject to injury by the tamping stick. This injury is liable to cause either a misfire, or worse still, a "hang fire." In my opinion the cause of hang fire in blasting is due not so frequently to defect inherent in the fuse as to dampness and two other causes—injury of the fuse by the tamping stick and burning the end of a fuse that has failed to spit, instead of again splitting the fuse and spitting the powder train. When the primer is placed on top the dynamite is more apt to be properly consolidated and the fuse less liable to be injured.

Finally the position that Mr. Tom has taken reminds me of a Swedish miner who worked in a Western mine. He was so afraid that a flying rock would jerk out a fuse that, after tamping a stick of dynamite in the bottom of the hole, he always put the primer in fuse-end first, taking this chance of breaking the cold fuse with such a sharp bend just "because you would have to jerk out the whole charge to get that fuse." I, for one, am disinclined to take the extra chances of misfire, especialy in wet holes, the extra trouble in loading and the other disadvantages attending the placing of the primer near the bottom of the hole just because there may be a little less danger of a flying rock jerking out the fuse.

In closing, Mr. Tom calls attention to the fact that most miners put the primer near the bottom of the charge. True, and most miners also think that the force of an explosion is greater in one direction than another. The point is that most miners do a thing the way they first learned to do it. Mining is no trade. There is no system of apprenticeship, and the way a miner does any particular detail is generally the result of habit, not of planning. Therefore, in my opinion, the way that most of them do a certain thing indicates little more than that miners as class follow the leader. One of the great misfortunes of mining is that now, owing to the greater complexity of mining problems, it is rare that the prospector or the working miner works himself higher than a foreman. Now many mines are run by college men who, not having worked as miners themselves, do not appreciate how little miners really know about their "trade." As a result, too many mining men assume that the way that most miners do a thing must be the right way to do it, especially if it is a little more inconvenient. Another trouble is that most men managing and superintending mines think that the smaller details of the work in the stopes and drifts are not worthy of study and discussion, assuming that miners have already worked out the details of their trade. Indeed, owing to this assumption that the miners know enough to take charge of themselves, the men in charge of mines do not inspect the working places carefully, and accidents at mines, which are due mainly to falls of ground, are as frequent as in the past.

In closing I must say that I am glad that Mr. Tom believes in discussing the practical details of mining, and I hope that others will join in. Many a miner has been killed by drilling into a missed hole or walking back on a hang-fire. The most probable causes of these seem to me to be a subject worthy of discussion; will not some others give their opinions? For my part I think it not only safer, but better mining to put the primer on top of the charge.

J. K. HAY.

Scranton, Penn., Nov. 9, 1908.

Electrolytic Chlorine in Chlorination Mills

In "Questions and Answers," in the JOURNAL, of October 24, p. 824, the answer to an inquiry concerning gold chlorination is as follows:

"It has frequently been proposed to employ chlorine generated by the electrolytic decomposition of common salt * * * but in spite of this estimated economy, the electro-chlorination process has not yet come into use."

Permit me to call attention to the fact that at the Goldfield Cl Mill, Goldfield, Nev., this process has been in successful commercial operation for some time, and is now treating Mohawk ores of the Goldfield Consolidated Mining Company, concentrates from the Combination mill and concentrate tailings from the Kinkhead mill, besides certain other ores of the camp.

Several references to this mill have appeared from time to time in the columns of the JOURNAL, but these were written before the plant was in operation, and at a time when, because of the absolute newness of a number of its features, there was widespread doubt in Goldfield as to whether the plant ever would result in profit to its owners. These doubts are now dispelled.

FERDINAND H. GRASER.

Philadelphia, Penn., Nov. 4, 1908.

Nevada Consolidated Copper Company

Following is an abstract of the report of Pope Yeatman, consulting engineer, of this company, presented at the recent annual meeting:

Prospecting has been done on the Eureka section and over 5,500,000 tons of an average grade have been developed. This increases the amount of ore blocked out from 14,432,962 tons to fully 20,000,000 tons. The possibilities for a very large increase of tonnage are very great; not only through a considerable extension of the present developed orebodies and partially prospected areas, but also in large areas not yet touched, which give similar indications of promise to those shown in the developed area. The prospecting carried on has been of such a nature as to also greatly increase what might be called "Possible Ore Reserves." Drilling is now being continued and further ore is being rapidly developed. In the Ruth section, one drill hole, in ore, is so placed as to prove a continuation of the rich Ruth orebody for a considerable distance. Drilling is to be continued on this ground also.

Work with the steam shovels was resumed on the stripping of the overburden the latter part of March and has been continued since. In the latter part of May, regular operations were commenced in mining the Eureka deposit with the steam shovel, and enough work has since been done to show the value of this method of working the Eureka deposit. Up to Nov. 1, 185,277 tons of sulphide ore have been mined. The total yardage up to Nov. 1 for stripping is 427,244.

STEPTOE VALLEY S. & M. COMPANY

During the latter part of 1907 work on erection was considerably curtailed, but the force was increased in January, 1908, and very materially so in April of the same year, since which time construction has been carried on vigorously. The concentrator, designed for the treatment of 4000 tons of ore per day, is now completed with the exception of the sixth section, which should be placed in commission in December. The capacity of the plant has been proved to be equal to or greater than originally estimated, and the results obtained, though capable of improvement, may be considered satisfactory. The plant is now being operated with two sections on Cumberland-Ely ore and three sections on Nevada Consolidated ore. The sixth section will be used for Nevada Consolidated ore.

Ten McDougall roasters have been erected and four are now under construction. Two reverberatories have been built and both have been proved to be satisfactory. The output has been large, and it has been found that no special coals are required, but successful operations have been carried on with the ordinary coals of Wyoming and Utah. Natural draft is sufficient. The first furnace was charged on June 22. The stacks and flues have been tried out and have proved eminently successful. The blast furnace is now under construction and should be completed by the end of the year. The converter plant of three stands was blown in July 9, and since then all three stands have been in operation at different times.

Owing to the increased development of ore the board has authorized the increase of the plant for the treatment of Nevada Consolidated ore. Additions are now under way and should be completed by April next. The additions consist of increasing two units of the concentrator by 15 to 20 per cent. and adding a fourth unit with a capacity of 15 to 20 per cent. more than the old single units; two McDougall roasters; one reverberatory furnace; one stand of converters. It is now recommended that still another unit be added to the concentrator for the handling of Nevada Consolidated ores.

Mineral Production of India in 1907

Of the ores produced in India in 1907 gold was by far the most valuable. Of the 556,488 oz. produced 535,085 oz. came from the Province of Mysore; 13,383 oz. from Hyderabad; 4017 from Dharwar; 3838 from Burma; and 165 from the other provinces of India. The Central Provinces produced 686,572 long tons of manganese ore and Madras 151,890 tons; the other Provinces produced 59,883 tons. Of the total iron ore produced (67,667 tons) the Barakar Iron Works consumed 65,524 tons. In addition to the above there was produced 7274 tons of chromite in Baluchistan and 79 tons of tin ore in South Burma. The production of ores and of gold is summarized in the accompanying table:

PRODUCTION OF ORES AND OF GOLD IN INDIA IN 1907.

Substance.	Unit.	Quantity.	Value.
Chromite	Lg. T.	7,274	£ 9,699
Iron ore	Lg. T.	67,667	13,381
Manganese ore	Lg. T.	898,345	403,528
Tin ore	Lg. T.	79	11,882
Gold	Oz. Troy	556,488	2,133,691

The production of coal in India was greater, in 1907, than in any previous year and ranked first among the country's mineral resources. Bengal produced 9,993,348 long tons (£2,208,091) the other Provinces contributing 1,153,991 tons. Petroleum was produced principally in Burma which is credited with 148,888,002 gal. out of a total of 152,045,677 gal. Salt was produced in India to the amount of 1,192,992 tons of which 123,092 tons came from the rock-salt quarries in the Punjab and Kohat districts. Saltpeter was obtained mostly in Behar. Alum is manufactured, from pyritous shale, in the Mianwali district; a small quantity of alum is made together with the sulphates of copper and iron near Khetri, State of Jaipur, Rajputana.

GEMS AND PRECIOUS STONES

India has always been noted for its rubies and jadeite and in 1907-08 the exports of jade by sea and land amounted to 4897 long tons, all obtained from the Myitkyina district, upper Burma. All the rubies and spinels were obtained in Burma but sapphires to the value of £3144 were produced in Kashmir. The accompanying table gives data of production of coal, minerals and gems in India in 1907:

PRODUCTION OF COAL, GEMS AND OTHER MINERALS IN INDIA IN 1907.

Substance.	Unit.	Quantity.	Value.
Coal	Lg. T.	11,147,339	£2,609,726
Alum	Lg. T.	276	2,500
Amber	Lg. T.	2	385
Borax	Lg. T.	*367	*10,002
Diamonds	Carats	628	2,784
Garnet	Lg. T.	5	759
Graphite	Lg. T.	2,433	7,387
Jadeite	Lg. T.	†4,897	†74,509
Magnesite	Lg. T.	186	37
Marble	Lg. T.	2,571	1,494
Mica	Lg. T.	†1,946	†228,161
Petroleum	Imp. Gal.	152,045,677	610,015
Rubies	Carats	282,030	93,428
Spinel	Carats	30,974	890
Sapphires	Carats	327,213	3,940
Salt	Lg. T.	1,192,992	433,744
Potassium nitrate	Lg. T.	*17,879	*274,679
Steatite	Lg. T.	8	201
Tourmaline	Lb.	20	293

*Exports in 1907.
†Exports in 1907-08.

There were also produced amber, garnet, graphite, magnesite, mica and steatite.

The weight of a close-link chain is about three times the weight of the bar (of equal length) from which it was made.

Kerr Lake Mining Company

The property of the Kerr Lake Mining Company consists of 40 acres in Lot 3, Concession IV; 12 acres adjoining on the north and forming part of Kerr lake and a strip to the southwest containing 4.96 acres. The property is in Coleman township, Cobalt district. The report is for the year ending Aug. 31, 1908.

NO. 7 SHAFT, POWER HOUSE AND MEN'S QUARTERS, KERR LAKE MINE

There are five payable veins, the most important of which are Nos. 3 and 7. Shafts have been sunk on these last veins to depths of 325 ft. and 180 ft., respectively. Development consists of 3000 ft. of drifting; 1350 ft. of crosscutting, and 1125 ft. of sinking and raising; total, 5475 ft. In addition there have been done about 1000 ft. of diamond drilling. The ore is stated to be high-grade at 300 ft. from the surface on No. 3 vein, and No. 7 vein shows high-grade ore at 100 ft., but lower in value at the 150-ft. level. It is believed that this vein will improve with depth under the lake.

Production and Costs

In the year ended Aug. 31, 1908, there were 528 tons of high-grade ore mined and smelted. The silver content was 1,473,712 oz., valued at $787,555, or 2791 oz. per ton. Because the ore occurs in narrow seams, the cost of mining (including development) was high, being $264 per ton, but owing to the high silver content the cost of producing an ounce of silver compares favorably with other mines at Cobalt. A summary of costs is given in the accompanying table:

COST OF PRODUCING SILVER.

Item.	Cost.	Cost per Oz.
Production and development.	$139,531	$0.09468
Shipping, smelting, etc.	76,093	0.05163
General expense.	32,905	0.02232
Construction and machinery.	57,419	0.03896
Total	$305,948	$0.20759

Practically all of the ore produced came from veins Nos. 3 and 7, the former producing 168.45 tons and the latter 353.86 tons.

The equipment on the property consists of four shafts with ore-sorting and crushing facilities at No. 3 and No. 7 veins; compressor and boiler house; bunk house for 125 men; cooking and eating house. The men employed averaged 100 per day.

The treasurer's report states that $740,436 was received from the sale of ore, and that $116,772 is due from the smelters. Total, $857,208 in 1908, against $347,855 in 1907, and $176,717 in 1906. Dividends in those years were $360,000, $210,000 and $190,000, respectively.

RIGHT-ANGLED LATERAL FAULT AT 110-FT. LEVEL, NO. 7 VEIN, KERR LAKE MINE

Further Flotation Process Litigation

In the case of British Ore Concentration Syndicate *vs.* Webster, Ballot *et al.*, November, 1907, the Elmore interests sought to recover damages from the defendants, who are also directors of Minerals Separation, Ltd., for an alleged nonfulfilment of contract. This action involved the ownership of the oil-gas flotation process, but had no bearing on the validity of patents. In the trial court the defendants (directors of Minerals Separation, Ltd.) won, but the British Ore Concentration Syndicate, Ltd. (the Elmore interests), appealed, and the appeal court sent the case back to the lower court for retrial on the ground of insufficient evidence taken at the first hearing. On Oct. 22, 1908, this case came up for this second trial before Judge Parker in the High Court of Chancery, London. After five days' trial the plaintiffs withdrew their case, the clause in the contract on which suit was brought was stricken out, any imputations which might have been made were unreservedly withdrawn, and each party agreed to pay its own costs.

During the half-year, ending May 31, 1908, there was raised from the underground workings of the Broken Hill Proprietary Company a total of 273,557 tons of ore, as compared with 312,158 tons during the previous year.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

A. M. Bilharz, of Flat River, Mo., is in Guerrero, Mexico.

Martin Schwerin, of New York, was recently in San Francisco.

F. Lawrence, of Australia, is in Mexico examining mining properties.

Zebina Lane has returned to Australia, after a long stay in California.

Frank A. Losh, of San Francisco, is examining mines in Oaxaca, Mexico.

Cortlandt E. Palmer has removed his offices to No. 71 Broadway, New York.

Lane C. Gilliam has returned to Los Angeles, Cal., from a prolonged trip to Alaska.

Wilfrid B. Wainewright, of Los Angeles, Cal., is now in New York on mining business.

J. R. Finlay, of New York, has gone West on professional business, expecting to return about the end of November.

Henry F. Lefevre has completed an examination of the Big Halstead mine in Plumas county, Cal., for himself and associates.

M. B. Washington has taken charge of the construction of the new cyanide mill for the Navidad Mining Company, at Oaxaca, Mexico.

A. H. Woodward, general manager of the Woodward Iron Company, has returned to Birmingham, Ala., after two months spent abroad.

S. E. Bretherton, of San Francisco, has returned from a trip North to the coast range where he has been engaged on professional work.

Dwight A. Jones, of New York, president of the San Vicente Mining Company, is visiting the company's properties in the State of Guerrero, Mexico.

George Gordon Crawford, president of the Tennessee Coal, Iron and Railroad Company, has returned to Birmingham, Ala., after a month spent in the North.

Hiram W. Hixon sailed from Philadelphia for London, Nov. 7, accompanied by his wife and daughter and Miss W. A. Heywood. His address in London will be 4 Broad Street place.

J. J. Jordan has been appointed assistant superintendent of the Blue Creek division of the Tennessee Coal, Iron and Railroad Company, with office at Johns, Ala. He has been master mechanic for some time past.

James G. Ross, of Montreal, has been commissioned by the Provincial Government of Quebec to investigate the mining methods of Austria, Turkey, Greece, Rhodesia, New Caledonia and Japan, including the systems in operation for the administration of mineral lands.

Robert Mond, son of Dr. Ludwig Mond was in Toronto recently on his return to England after a visit to the Sudbury nickel district of Ontario, in connection with important experiments in progress there under Dominion government auspices with a view to the electrical treatment of the nickel-copper ores.

Professor Dorsey A. Lyon, who has been for several years head of the department of metallurgy, at Stanford University, has now become permanent manager of the iron smelting plant at Heroult, on the Pitt river, in Shasta county, California. He has been experimenting for some years with electric furnaces and has devised a process for smelting iron by electricity. In his new position he will be enabled to make extensive investigation in the direction indicated.

Obituary

Henry A. Butters died in Berkeley, Cal., Oct. 26, aged 58 years. He was born in Haverhill, Mass., and went to California when a boy. After several years spent in mining there, he went to Leadville, Colo., where he remained for several years. Later he turned his attention to electric work, and about 1890 went to South Africa, where he built the Johannesburg tramway system. He returned to California in 1895 and organized the Northern Electric Company.

R. Lee France died in Chicago, Nov. 2 aged 69 years. He was born in Washington, and after serving in the War became a civil engineer. He received his training under Benjamin H. Latrobe, the most eminent of the older generation of engineers, and rose to be his assistant in the building of the Pittsburg & Connellsville Railroad. He was one of the first to appreciate the future importance of the Connellsville coke district, and aided materially in its early development. Later he settled in Chicago and entered the coal business. He was largely interested in opening the Fairmont and Quinnimont coal districts in West Virginia, and later mines in the eastern district of Kentucky.

J. D. Crabbe, who died in Springfield, Ill., Oct. 13, aged 60 years, was one of the oldest coal operators in Illinois. He was long general superintendent of a part of the property of the Consolidated Coal Company, of St. Louis, and was general sales agent for the Consolidated at one time. He was then general manager of the Madison Coal Corporation, being succeeded by A. J. Moorehead when he became identified with the Mount Olive & Staunton Coal Company. He was with this latter company when the Staunton mine was opened. He then became receiver of the Litchfield mine; after this property was sold to the Illinois Collieries Company he retired from active business.

William Carkeek died at his home in Los Angeles, Cal., Oct. 21. He had suffered in recent years from a complication of diseases, the principal trouble being asthma. Mr. Carkeek was born in Cornwall, England, in 1856. He became a resident of this country in 1877, engaging in mine and mill work in Colorado and Idaho. There were four brothers in the family and all of them were engaged in the milling of ores throughout their lives, their field of work being Colorado, Idaho and Montana. In 1883 William Carkeek became superintendent of the concentrator for the Colorado Mining Company, of Butte, Montana. He remained with this company for 19 years, and became a recognized authority on practical concentration. His health failed in 1902. It is the opinion of many that his lungs became paralyzed from inhaling small particles of mineral. He sought Lower California and then Arizona for relief. While in Arizona, in 1903, he still maintained strength enough to design and erect the Shannon Copper Company's concentrator. His wife accompanied him through Arizona, and in 1904 they took up their residence in Los Angeles. Mrs. Carkeek still survives him. Mr. Carkeek, having passed a busy life, his sickness worried him.. In 1907 he resolved to make a trip to Montana to see if it were not possible to recover in a colder climate. This trip proved disastrous, only hastening his death.

Societies and Technical Schools

Western University of Pennsylvania—Dr. M. E. Wadsworth, dean of the School of Mines, at Pittsburg, has adopted a system, original with himself, of granting provisional credits for work at actual mining done during the summer vacations; these credits to be made absolute upon presentation of a thesis, or a report, of all work done. This will enable a student to graduate in three years, instead of four.

Scranton Miners' Institute—The first winter session was held in the Young Men's Christian Association building, Scranton, Penn., Nov. 9, Mine Inspector Hubert Johnson presiding. John Hale, the oldest mine foreman in the Lackawanna valley, read a paper on the formation of coal, which was an interesting exposition of the geological progression of the formation of coal from the vegetation of the Carboniferous age to the time in which it became what we know it to be. After Mr. Hale's paper, there was an interesting and practical discussion on the question, "Does it pay to flush mines for the purpose of robbing pillars?" A number of members joined in the discussion.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Salt Lake City, Denver, Butte and Goldfield

REVIEWS OF IMPORTANT EVENTS

San Francisco

Nov. 7—In pursuance of the order made by Judge Deitrich of the United States Circuit Court last week, the Indiana Gold Dredging Company at Oroville, has commenced the cutting of a canal 50 ft. wide on the bottom, through the tailings and rock piles thrown up by the stacker of the dredge, just below the town. It was thought by the court that this cut through the tailings pile would be sufficient outlet to prevent the Feather river backing up into the city and doing damage during the flood season. If this proves to be insufficient the cut will have to be made larger, or the dredge will have to stop work. The Pennsylvania Dredging Company at the same place has at last landlocked its dredge and the injunction obtained against it by the Anti-Débris Association has been dissolved in consequence.

The first furnace of the Balaklala Copper smelter at Coram, Shasta county, was blown in on Oct. 20, making the fifth copper smelter in the county. The others are the Mammoth at Kennett, the Bully Hill at Winthrop, Mountain Copper at Keswick and Afterthought at Ingot. The new smelter has a capacity of about 1500 tons of ore daily. There are three blast furnaces and a reverberatory. The 16,000-ft. aërial tramway has also been put in operation, bringing ore from the Balaklala and Trinity mines to the smelter. About 200 men are employed at the smelting plant of the company aside from those engaged in mining. In addition to the furnaces there are converters and three McDougal roasters at the plant.

Judge Gray, of the Superior Court at Oroville, Butte county, has denied the application of L. A. Churchman for the appointment of a receiver for the P. B. Steiffer Mining Company. The complainant alleged fraud in the manipulation of the stocks of the company by its president and secretary who had been indicated by the grand jury. The judge denied the motion on the ground that enough facts had not been presented to substantiate the allegations of fraud. The troubles of the company appear to be due to differences between factions of the stockholders, some backing up the Steiffers and others opposing them. A great deal of stock in the corporation has been sold in different parts of the State. The mine is supposed to be on the old Perschbacker channel, on the Magalia ridge, in Butte county.

The Crœsus Gold Mining and Milling Company, operating the old Plumbago mine near Alleghany, Sierra county, is installing one of the most complete electric power plants for mining purposes in the State. With this new power plant the lower adit now 4000 ft. long, will be extended an additional 5000 ft., bringing it out on the Kanaka creek slope. Mason W. Mather is manager of this company. In the vicinity of the same town after driving for two years on a 1400-ft. tunnel on the Tightner mine, it has been completed and the same rich streak of ore found that exists on the upper levels.

Goldfield, Nevada

Nov. 3—The most important event of the week is the entrance of Samuel Newhouse, of Salt Lake, into Nevada mining through the purchase of the Silver Peak Valcalda mines at Blair. This property has been under development for several years by the vendors who acquired it when only a prospect. The 10-stamp mill on the property has been treating 30 tons per day and has paid for the further development of the mine.

The J. C. McCormack Company, of Goldfield, has opened up a high-grade mine at Clifford. The mine shipped ore three years ago, and shipments have been made occasionally since then; in all 400 tons have been shipped. This ore was hauled nearly 60 miles. A dispute between the owners hampered development and clouded the title which has just been cleared. Present shipments under the new management are running from $335 to $659 per ton for 50-ton lots, and it is probable that enough ore will be extracted to make the final payments on the property in December.

The presence of high-graders was again brought vividly to mind last week by the arrest in Tonopah of four men as they came off shift at the MacNamara mine where two recent strikes of high-grade ore have been made. One of the men arrested was vice-president of the Tonopah Miners' Union. Ore worth several dollars a pound was found on these men and in their dinner buckets; later a search of their cabins revealed a wagon-load of rich ore.

An echo of the earlier bonanza leasing days on the Mohawk claim comes from Carson City where the suit brought by the Mohawk Mining company against the Francis Mohawk company was taken on appeal. The plaintiff asks damages in the sum of $125,000. By stipulation the hearing of the appeal has been deferred.

The Lucky Boy mine near Hawthorne has been forcibly seized and is being held with shotguns by the former owners who claimed that J. T. Hubbard has failed to make the second payment for the purchasers, amounting to $30,000. Mr. Hubbard is one of the directors of the Goldfield Consolidated; he claims that the payment was made through a local bank. All parties concerned are now in Goldfield to find the money and call off the gun men.

Work in the Bulls and Bears property will soon begin and a long fight will be ended. Owing to rascality on the part of the man in charge the money sent by the foreign corporation for annual labor in 1904 was squandered and an insufficient amount of work done. The ground is in one of the most promising prospecting areas in the Goldfield camp, and it was promptly relocated by "jumpers." When the former owners applied for patent on their ten claims the "jumpers" adversed it. In order to clear the title the former owners have given 100,000 shares of stock and have deeded outright three of the claims to the adverse claimants. The Norcross shaft is at present 125 ft. deep; the work of sinking it to the 1000-ft. level will soon begin.

Salt Lake City

Nov. 5—More than $15,000,000 worth of mining stocks were sold on the Salt Lake Stock and Mining exchange during the ten months ending Oct. 31, which is nearly $1,000,000 in excess of the total business transacted during the year 1907. Salt Lake City has been steadily growing in importance as a mining-share market center for a number of years until now the local exchange is regarded as being one of the most progressive organizations of the kind in the United States. Not long ago, in recognition of this, Samuel Newhouse presented the association with a valuable piece of real estate, the only consideration being that a creditable exchange building be erected thereon. The exchange management agreed to this and the preliminary steps have been taken to carry out the contract. Plans have been drawn for the new structure, which it is estimated, will cost at least $100,000.

It has been announced that the Harriman railroad management will build a branch line into the Yerington copper district in Nevada; this branch will leave the main line of the Nevada & California railroad near Wabuska, about 40 miles from Hazen. The Nevada Douglas Copper Company is advancing the funds required to build the line as far as its mines, a distance of about 15 miles, but the

money will be returned in the shape of freights. The Nevada Douglas mine has been extensively developed and engineers have estimated that there are several million tons of ore, blocked out ready for extraction, that will average 6 per cent. copper and a very large tonnage that will assay considerably higher. With the completion of the railroad it is proposed to erect an independent smelter, and, while the matter has not been altogether settled, it is possible that the Mason Valley Copper Company, operating in the same district, will join in the smelter enterprise. A spur of the railroad will be run to the Mason Valley properties also. The Nevada Douglas Company is controlled by Salt Lake and Boston parties with Walter C. Orem, of Salt Lake, as general manager.

The directors of the Utah Copper Company will meet soon in order to declare the last quarterly dividend for the year which will be paid in December. During September the company produced approximately 4,250,000 lb. of copper; the October output is said to have been approximately the same.

The Bullion-Beck mine has been involved in litigation at various times which finally resulted in the discoverer of the property not only losing all his interests in it, but also a fortune which was eaten up by lawyer's fees. John Beck was at one time a familiar character in Utah mining affairs, but after once losing his prestige, it could not be regained. It is the intention of the United States company to explore the mine from the lower workings of the Centennial-Eureka mine, which it has owned for a good many years and which has supplied the bulk of its Utah earnings.

The Fink furnace, for which Edward Fink, the inventor, is making great claims will be tested on a commercial scale at Garfield in the near future. The attention of Samuel Newhouse was called to the furnace some months ago and after his engineers had investigated, concluded that it was worth while to spend some money on it. Accordingly, Mr. Fink was instructed to build a furnace that would treat 100 tons of ore a day. The Boston Consolidated Mining Company, of which Mr. Newhouse is president, granted permission to use a portion of its premises as the site for the new plant; so the plant will be built there. The equipment has arrived and will be installed immediately. It is thought that the furnace will be blown-in about Dec. 1. Mr. Fink claims that the furnace is able to treat all classes of ore. The inventor will be in charge of the construction and operation of the plant through the demonstration stages.

While there is nothing revolutionary in the Fink process, it is a development in metallurgy. The inventor claims that a better utilization of the heat units is accomplished through his device which consists of two revolving reverberatory furnaces and a central fire-box and a cluster of air pipes installed between these furnaces. Each of the twin furnaces, for what is designed to be a 100-ton plant is only 9 ft. long. These revolve slowly during the heating process, thus constantly exposing new surface where the heat blown-in is most intense. The heat goes in at the outer end of one of the furnaces, is conducted entirely around the charge, and then passes into the other furnace. While this accomplishes greater utilization of the heat, it reaches a higher point in the first furnace than in the second; on this account the reversal of the process is provided for.

It is claimed for this new arrangement of an old process that it is a furnace and converter combined; that it will produce blister copper with one melting. It is further claimed that no coke is required, as coal or slacked coal will suffice to bring the desired results. Owing to this, the inventor declares that the cost of the fuel will be cut in two. The commercial possibilities of the furnace, however, are yet to be worked out.

Butte

Nov. 5—With the gradual advance in the price of copper the outlook for increased activity in the camp has brightened materially. There are a number of leasers and small independent properties which will be able to resume operations when the price of the metal reaches 15c., but which have been closed down for the past year or more.

Word has been received in Butte that the Butte & Superior Copper Company has won its suit in Duluth against John McAlpine. The suit was brought some time ago to enforce the payment of $2000, alleged to have been due from McAlpine on his stock subscription. McAlpine refused payment on the ground that the property held by the company had been misrepresented to him and was in fact valueless, and that his subscription had been obtained by means of the false statements of the promoters. The suit has been watched with much interest here and its outcome is practically a vindication of the company's claims as to its property.

The president of the Raven Mining Company has issued a circular letter to stockholders, apprising them of the work done on the company's property from June 1, 1907, to Sept. 11, 1908. It states that during that period the shaft was sunk from the 700- to the 1127-ft. mark and that a total of 5000 ft. of crosscuts and drifts were run. Leasers working on the property have paid the company royalties to the extent of $2771, in addition to doing much development work, which would otherwise have been an expense to the company.

Indianapolis

Nov. 9—The State mine inspector's force is now making the final visit to the mines of the State to be covered in the annual report. They are having less trouble with both miners and operators as to violations of the law than ever before. At the beginning of the year there were many prosecutions until operators and miners learned that the old lax methods due to the lack of a sufficient force under the inspector were not to continue. While the inspector opposed the amendment to the law by which the permitted size of the bit in the drill is enlarged, the amendment did not restore the old dangerous conditions, as many supposed. Under the old law the miner drilled a foot or more beyond the line where the machine had cut the coal, thus lodging powder charges in the face of the coal. There were frequent instances of the shots being forced out of the hole instead of breaking the coal. The new law prohibits drilling ahead.

The Indiana Railroad Commission has been advised that a water famine prevails in the mining districts of southwestern Indiana to the extent that water must be hauled in large tank cars from Terre Haute, Vincennes, Evansville and the Wabash river. The railroads have filed an application with the commission for a water rate. A rate on water is not included in the regular tariffs, as it was not thought that it would ever become necessary to ship in quantities such a commodity as water. The railroad commissioners say they realize that just at this time there should be no impediment to the operation of coal mines and the question of rates for hauling it on the cars will receive prompt attention. It is thought a rate of $4 a car will be made.

Toronto

Nov. 5—J. A. Macoun, of the Geological Survey of Canada, has returned from a trip over the line of the Canadian Northern railway from Edmonton to the Pas, in the course of which he examined a number of extensive peat beds and secured samples. These will be scientifically tested in the laboratory at Ottawa to ascertain their economic value, and the results will be widely published in the expectation that capital will be attracted for the development of this source of fuel supply.

Last week the "Cobalt Silver Special," a train comprising 13 cars loaded with ore, left Cobalt direct for the plant of the American Smelting and Refining Company at Denver, Colo. The combined weight of the ore was about 400 tons, and the train was decorated with large streamers indicating the mines supplying the shipment. These were La Rose, four cars; Kerr Lake, O'Brien and Temiskaming & Hudson Bay, two cars each; and Crown Reserve, Temiskaming and Chambers-Ferland, one car each.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

Official announcement is made that the Alabama Consolidated Coal and Iron Company will expend something like $1,500,000 on improvements and development on the property in this State, the work to be taken up at once.

The Tennessee Coal, Iron and Railroad Company is collecting common labor for construction work, to be used, it is understood, in the new development of the steel works at Ensley, as proposed by President Crawford. Other manufacturing concerns in this district have planned considerable construction work, and much labor will be employed steadily for some time to come.

Jefferson County

Dr. C. B. Crowe, president of the Yolande Coal and Coke Company, has purchased property at North Birmingham in close proximity to the foundry of the Dimmick Pipe Company, and will erect a large battery of coke ovens. The gas from the ovens will be used for steam purposes. Coke-drawing machinery will be used.

Walker County

Pratt Consolidated Coal Company—This company, G. B. McCormack president, is now the largest commercial company in the State. It has recently taken over the Victor mine at Dora, owned by the Walker County Coal Company.

Arizona

Imperial—The second furnace at the smelting works has been blown in. Two more furnaces will be built in 1909. Ore shipments to the smeltery in October averaged about 380 tons per day.

Gila County

Mallory Shaft—Sulphides have been struck in the west drift. The importance of the strike has not yet been determined.

Gem—The vein holds up well, both as to size and as to the grade of the ore. Shipments to the smelter amount to two and three cars a week.

Superior & Boston—About 50 tons of ore are daily shipped to the El Paso smelter.

Great Eastern—The east drift on the 480-ft. level is still in ore, although it is not of as high grade as formerly.

Arkansas

Marion County

Blue John Mining Company—This new company has bought the property of the Reynolds Mining Company near Yellville, and will start work on it soon. The headquarters are at Kansas City, Mo.; C. H. Rudolph is president, and C. Callahan treasurer.

California

Amador County

Bunker Hill—This company at Amador City, E. H. Harrington, superintendent, has declared a dividend of 3c. per share.

Delucchi & Garibaldi—At this claim near Volcano, formerly known as the Boardman, a pay-streak of gravel has been encountered.

Butte County

Bills Brothers—At this claim on the Blue Lead, five miles from Oroville machinery has been installed and active operations begun.

Blue Lead—In this property near Bangor, superintendent Lambert in crosscutting has found good pay gravel.

Phoenix Group—In this group, five miles from Hurleton, where the ledge was recently encountered rich ore is being taken out.

Fresno County

Big Sampson—At this mine, near Dunlap, the machinery has been installed and negotiations are under way for purchasing other mines.

Humboldt County

Asbestos—Williams, Bryant & Stevenson, of Eureka, have located five asbestos claims at Soldiers Grove on the divide between Mad river and Van Duzen river, near Fort Baker.

Inyo County

Black Cañon—At this mine, north of Big Pine, rich ore has been found in an old abandoned shaft in the main tunnel of the property.

Keane Wonder—This company, Homer Wilson manager, has cleaned up $14,000 in 22 days' run at the mill. The output from the mine is increasing.

Mariposa County

Hart—H. E. Miner and J. F. Robinson have taken a five-year lease on this mine and will commence work at once. It was formerly a producer.

Modoc County

Hess—At this mine on Schafer mountain, between Adin and Canby, a five-stamp mill is being erected.

Mono County

Parrott—The mine at Lundy, owned by Jasper Parrott, has been sold to a company which is surveying for a 2300-ft. tunnel.

Nevada County

Gauthier—At this mine above the Idaho-Maryland, Grass Valley, the shaft is being enlarged to two-compartment size, and machinery will soon be installed.

Lecompton—In this mine at Nevada City, Samuel Colt, superintendent, some valuable ore is being mined. The men are at work sinking the shaft and running drifts.

St. Gothard—This company, operating the Delhi mine has declared a 5c. dividend amounting to $5000. Hamilton Eddie is superintendent.

Plumas County

Beckwith—The copper and gold claims north of this place are to be actively developed to determine the exact values.

Gold Stripe—This property, owned by F. J. Standart, of Greenville, and Mrs. C. O. Hamilton, of Auburn, has been bonded to W. R. Wharton, of Los Angeles. Some 3000 ft. of development work has been done on the property.

San Bernardino County

Seal of Gold Mining Company—This company has leased for five years all its properties to H. B. Slater of Riverside. He pays a 5-per cent. royalty on ore extracted.

San Diego County

Artery—B. Garwoood, who recently took over the holdings of this company at Dulzura, has erected a new five-stamp mill at that camp.

Shasta County

Balaklala—Mine and smelter are practically closed owing to accident to the tramway, which it will take 30 days to repair.

Tom White Channel—This rich old channel which was lost years ago has been again found by Russell Brothers, half a mile south of the town of Igo. The owners kept the find a secret until they had bought up considerable ground adjoining their claim.

SIERRA COUNTY

American Mining and Development Company—This company, which is working the Snowden Hill mine, has completed its two-mile ditch and reservoir and laid in supplies for the winter. The tunnel being driven to the gravel channel is in very hard bedrock.

SISKIYOU COUNTY

Allen Sovy & Co.—This company, which is developing a quartz mine on Taylor creek, has struck a bunch of high-grade ore.

Diamond Group—In these claims on China gulch a new ledge carrying high-grade ore has been discovered.

TRINITY COUNTY

Globe—This property above Dedrick is now equipped with an electrically driven 10-stamp mill. Tunnels are being driven on the mine.

Trinity Gold and Timber Company—For this company at Minersville, W. V. Whipple manager, a lot of machinery has been ordered. This property was formerly owned by F. Beaudry.

TUOLUMNE COUNTY

App—At this mine, owned by the Rawhide Mining Company, the shaft is to be sunk below the 1300 level. A new foundation has been put under the hoisting plant.

McCormick & McPherson—At this mine near Jacksonville, Frank McPherson, superintendent, arrangements are being made for more machinery and a mill. The small mill will be enlarged to 20 stamps. High-grade ore is being mined.

YUBA COUNTY

Brandy City—At these mines, nine miles from Camptonville, a new stamp mill is to be erected to crush the cemented gravel.

Bessie A.—At this mine, Browns Valley, J. C. Campbell manager, they have installed a new compressor, and will shortly start up the stamp mill.

Colorado

TELLER COUNTY—CRIPPLE CREEK

The work on the drainage tunnel was advanced 287 ft. during October. The total distance driven up to Nov. 1 was 3811 ft. The water encountered in the portal heading gave a maximum flow of 300 gal. a minute, and exhausted itself after a week's flow. At the Intermediate shaft the work of cutting out the station at the tunnel level was completed, the compressor from the portal heading was installed and about 25 ft. of ground was broken in each of the two headings.

LAKE COUNTY—LEADVILLE

Adelaide—This property, Adelaide park, is being operated by Andy Dyatt and associates and shipping 50 tons weekly of a good grade of sulphides from the bottom of the old shaft. At the 300-ft. level drifts were run northeast and southwest, opening a good body of lead ore and when the ground is opened shipments will be started.

Big Six—Considerable improvement has taken place in this property, as the latest development work shows the orebody in place and shipments are averaging 30 tons daily; the ore runs well in gold.

Dinero Tunnel—The work of cutting across the vein to reach the hanging wall is still in progress. The bulk of the mineral opened so far, with the exception of several high-grade streaks, is low grade and will be treated by mill; but there is a considerable quantity that will bear shipping direct to the smelter.

Gallagher—This old property, North Iron, is again in commission, a lease having been secured by several Leadville men. The old shaft is being cleaned out and repaired, and when this is completed work will be carried on in the lower workings, where heavy shipments of rich ore were taken when the property was last worked; the lessees propose to continue the drifts from the levels into virgin territory. A new shaft will also be sunk 200 ft. south of the main wagon road to catch the extension of the orebody to the north.

Graham Park—Within the last month there has been considerable activity displayed in this section of the district and a number of old shafts have resumed work. From the old Iron mine the lessees are shipping 40 tons weekly, and the last returns from the smelter show 84 oz. silver and 24 per cent. lead. The Iron Hat is shipping two carloads per week of a good grade of iron and lead. On the south end of the Iron mine a new shaft is being sunk by lessees.

Penn—The lessees on this property, Breece hill, are doing very well and the property is shipping 200 tons daily. Frank Lanphier on No. 3 shaft is shipping an average of 300 tons a month of high-grade iron; other leasers are sending out silicious ores in addition to the iron.

TELLER COUNTY—CRIPPLE CREEK

Bonnie Nell—At this mine, on Raven hill, the shaft is to be retimbered and new machinery installed. The property is to be thoroughly explored and developed.

Morning Glory—The Union Leasing Company is now operating this mine, and is making regular shipments. Some high-grade ore has been encountered.

Old Gold—Brentlinger & Co., lessees on this mine, recently struck a 2-ft. vein of good milling ore in a part of the mine supposed to be barren. A trial shipment from this vein has been made.

Florida

POLK COUNTY

Tampa Fertilizer Company—This company has completed its manufacturing plant at Tampa, and is now starting mining operations on a phosphate deposit which it owns near Fort Meade. J. J. Singleton is manager of the company.

Georgia

LUMPKIN COUNTY

A movement is reported to consolidate some of the old mines near Dahlonega, with a view to operating on a larger scale than heretofore. Several plans of this kind in the past have had no success.

Indiana

BARTHOLOMEW COUNTY

At the depth of 50 ft. a vein of coal has been discovered on the John Ott farm. The drilling was continued and the vein proved to be about 25 ft. thick. Experts have pronounced it good coal. Local prospectors are of the opinion that a large mine is awaiting development. This is the first coal discovered in this county.

CLAY COUNTY

Crawford—President Golden, of the Block Coal district union will close down No. 10 mine of this company near Brazil. This will throw about 150 men out of employment. Mr. Golden says the company has been violating the joint agreement for some time, and has ignored all warnings from the district officers. The company insists that the fault is with the men.

GREENE COUNTY

The vein of coal discovered a week ago while drilling for water in the northwest part of the county has been investigated by capitalists of Bloomfield, and found to be of excellent quality. The vein is 9 ft. thick and only 130 ft. below the surface. Other holes will be drilled to discover the extent of the field, before sinking a shaft.

Louisiana

Petroleum production reported in October was 452,100 bbl., an increase of 14,300 bbl. over September. Shipments by rail for the month were 215,792 bbl.; pipe-line, 136,995; total, 352,787 bbl. To this should be added about 60,000 bbl. for refining and field consumption. There were 20 new wells completed in October, 14 yielding oil and one gas, while five were dry. On Oct. 31 there were 39 new wells in progress.

Michigan

COPPER

Ojibway—In cutting the plat at the first, or 500-ft. level of No. 1 shaft a well-defined lode was disclosed and when penetrated was found to be 20 ft. wide and heavily charged with copper throughout. The footwall has been in evidence throughout the sinking of the shaft in the form of a small calcite seam carrying some copper. It was believed to be but a

small off-shoot from the working lode; but from the character of the formation now opened it is thought to be the Kearsarge lode, which has either split or deflected. Crosscutting is now under way and definite information soon will be obtained. Sinking has been resumed in the shaft. At No. 2 shaft a crosscut is being driven to cut the lode and is nearing the approximated point of intersection.

Lake—The new air compressor is ready to go into commission and sinking will be resumed in the shaft, which is bottomed just below the second level, 300 ft. from surface. Drifting continues to the south from the first level, 300 ft. from the shaft and both ways from the second level. The formation at the second level has changed and now conforms with the general strike of the lodes in this vicinity. Because the lode as opened at the first level was slightly deflected it was thought by many to be a "freak" formation or pocket. The new hoisting engine is being rapidly assembled and when ready to go into commission a 3½-ton skip will be installed. Several additional buildings are to be added. The railroad has been completed to within a short distance of the shaft.

North Lake—This company has not yet succeeded in reaching bedrock with the sand pipe it is putting down prior to beginning diamond-drill operations; the pipe is now down over 350 ft. A second outfit will soon be installed and the ground will be thoroughly explored in this manner during the winter; with the information thus obtained ground will, in all probability, be broken early in the spring for shaft sinking.

Isle Royale—The new shaft on the Baltic lode is down about 25 ft. in the formation and encouraging copper ground is in evidence.

Franklin—The drifts from the 23d level of No. 1 shaft of the Franklin Jr. are entering good ground on the Pewabic lode. The shaft is down to the 24th level and a crosscut from that level to the lode will soon be started. It is also planned to drive a crosscut to intercept the conglomerate formation and ascertain its value at depth. It is locally believed that the old Franklin property will be taken over by the Quincy company and operations confined to the Franklin Jr. workings.

Ahmeek—Work on the stamp mill that this company is erecting on the shore of Torch lake is progressing rapidly and the foundations are about ready for the structural steel. The concrete collars of the two new shafts have been completed and sinking is going on rapidly.

Hancock—Sinking has been temporarily suspended at a depth of about 1300 ft. at No. 2 shaft, where a large station is being cut, preparatory to driving a large working crosscut to connect with the 13th level of No. 1 shaft. It is planned to use No. 2 shaft, which has five compartments, as the main working shaft, all rock tributary to No. 1 shaft to be trammed and hoisted through this shaft. Drifting on the West Hancock lode at the 11th and 13th levels continues with gratifying results. At the 13th level an extension of the crosscut revealed another lode highly mineralized about 100 ft. from the west lode.

Keweenaw—At the 11th level of the Medora shaft the drift to the west has encountered a highly mineralized fissure vein containing considerable mass and barrel copper; drifting on this fissure has been started and its extent fully determined. At the 13th level the west drift is being pushed in order to show this vein at greater depth. The Phoenix mill is handling about 100 tons daily and a much better showing is being made than heretofore.

Iron

Oliver Iron Mining Company—All the iron ore mined at the company's mines at Iron Mountain will be hoisted from the new Ludington shaft. A greater efficiency can thus be obtained than by keeping the Hamilton and Chapin shafts in service. It is the intention of the company to sink these last shafts to greater depths.

Missouri

Zinc-lead District

The supply of natural gas in the district is very poor at the present time, and many mines have gone back to using coal.

All Round the Clock Mining Company—This company has been incorporated at Joplin with a capital stock of $50,000. C. L. Woods & Co., of Cambridge, Mass., are the principal stockholders. O. E. Marshall, of Joplin, is also a stockholder.

A. B. C. Mining Company—This company, at Joplin, has been incorporated. A. B. Cole, of St. Louis, Robert F. Campbell and Mary S. Campbell, of Joplin, are the stockholders. Mr. Campbell is manager of the John Jackson land in Joplin.

John Jackson—Wilson, Robertson & Register have made a rich strike on the John Jackson land north of the famous John Jackson mine. Three drill holes found from 20 to 60 ft. of ore. W. H. Wilson, of Joplin, has charge of the operations.

Montana

Butte District

British Butte—The hull and framework of the new gold dredge is entirely completed and all the machinery is on the ground. The management expects to have the dredge in operation within six weeks. No trouble is anticipated in keeping the dredge at work throughout the winter since the water which is to be used comes from the mine and is of sufficiently high temperature to keep it from freezing. Another storage dam has been built, making four in all. Water from an adjoining spring will be used in the new dam.

Raven—Thirty thousand shares of treasury stock were recently sold to the large stockholders of the company at $1 per share without commissions. This additional capital will be used in sinking the shaft from the 1200- to the 1500-ft. level.

Copper Eagle—The shaft is down 365 ft., at which point a drift has been run 13 ft. Sinking has been temporarily discontinued. Drifting will be carried on at the 200- and 300-ft. levels.

Pittsmont—About 250 tons of ore are being mined daily, of which 200 tons is second class and the balance first class. The new concentrator is giving entire satisfaction.

Tuolumne—The newly ordered surface equipment, consisting of five carloads of machinery, has arrived on the ground.

East Butte—President Gross left for Boston a few days ago after outlining the plans for development work. It has been decided to crosscut and drift on the 400-, 800- and 900-ft. levels.

Jefferson County

Boston & Corbin—Two new 150-h.p. boilers have been ordered.

New Jersey

Sussex County

The work of drilling to determine a supposed deposit of zinc ore has been started on the Rude farm, near Hamburg. This is about three miles from the New Jersey Zinc Company's mine at Franklin Furnace.

Nevada

Esmeralda County—Goldfield

Owing to the refusal of one of the purchasing companies to give out figures because of an objection on the part of one of the producers, it is impossible to give the usual tabulated statement of the Goldfield production this week. This producer is supposed to be the Daisy, which is conducting a systematic campaign of mystery.

Red Hills Mining and Leasing Company—All damage occasioned by the recent fire which burned down the hoist, house and blacksmith shop has been repaired and underground development work has been resumed.

Florence Consolidated—This company, operating a lease in the Florence property, has taken a lease on the new Broken Hills bonanza at Clifford, in Nye county. A 15-h.p. gasolene hoist and a complete equipment of tools has been shipped to the new lease.

Gold Bar Fraction Mining Company—A contract has been let at $26.50 per foot to sink 250 ft. of shaft on the Gold Bar

Fraction; the contractor must furnish everything.

Daisy Florence—Mitchell & Fairfield have taken over the Daisy lease on the Florence. It adjoins the Engineers lease on the north and east. They will prospect the portion of the mine adjoining that claim and will also drive toward the Florence Annex, which had ore of a medium grade up to the line between the two leases.

Goldfield Merger—The shaft being sunk east of the St. Ives is now 540 ft. deep.

Adams Goldfield—Work on company account is to be resumed at this property, which lies north of Columbia mountain.

Engineers Lease—Since ore was struck four months ago, this lease has shipped $1,100,000 worth of ore and paid $360,000 in dividends. The lease expires on Nov. 8. Work of cleaning up has begun and the dumps are being sorted.

Victor Leasing and Mining Company—The oreshoot has been found again and ore is being broken on the 300-ft. level. The difficulty in locating the oreshoot was due to the flattening of the vein below the 250-ft. level.

Little Florence—Now that the treasury has been replenished by the settlement of the Florence-Little Florence litigation, work has been renewed on the lease on the Combination Fraction. The shaft is now 450 ft. deep. The new 40-h.p. gasolene hoist and the air compressor have been installed and are ready for work.

Florence Wheeler—On this lease, formerly that of the Florence Mining and Leasing Company, ore has been found at a depth of 240 ft. in a raise from the 300-ft. level. Two shifts have started on the 400-ft. level driving a crosscut for the Florence Consolidated vein.

Red Hills Mining and Leasing Company—The shop and hoist-house that burned has been rebuilt, and development work has been resumed.

Mohawk Ledge—The shaft is now down 685 ft., which makes it one of the deepest in the camp. The formation is changing and every indication points to the early encountering of the Kalfus oreshoot.

Crackerjack—Mitchell and Fairfield have what is probably the most favorable terms of any lease granted in Goldfield. The lease runs for three years with the usual conditions and the further stipulation that if a 10-stamp mill is built during that period an extension of three years will be granted. The maximum royalty is 20 per cent. and the royalty on milling ore is 15 per cent. A vein has been found at a depth of 75 ft.; ore from it assays $20 per ton. The formation is more or less broken, which is true of all the country round about Columbia mountain, on the northerly slope of which the Crackerjack is located.

Florence Goldfield—A 100-h.p. hoist has been installed at the main shaft.

Florence Consolidated—A five-drill compressor and a 30-h.p. electric hoist have been installed on this lease.

Goldfield Consolidated—The new mill on Columbia mountain is being closed in. The steel work is finished for all except the last three aisles. All the grinding and crushing machinery is installed and practically ready to run. Work on the concentrating and cyaniding departments is dragging. Foundations are being put in for the refinery. A station is being cut at a depth of 630 ft. on the Jumbo to connect with the main shaft on the Mohawk, which is down 600 ft. When this is done, work of sinking to cut the main Mohawk vein will be continued. It is estimated that this will be intersected between the 925- and 1000-ft. levels.

Esmeralda County—Silver Peak

Silver Peak Valcalda—The O'Meara brothers have sold to the Samuel Newhouse interests of Salt Lake, the Silver Peak Valcalda mine, which adjoins the Pittsburg-Silver Peak property. The Valcalda is developed to a depth of 450 ft., and is equipped with a 10-stamp mine. The ore reserves are said to justify even now the building of a 200-ton mill, plans for which are being prepared. The ore averages $15 per ton.

Esmeralda County—Hornsilver

Lime Point—L. H. Rogers and associates, of Goldfield, are contemplating the erection of a mill at their Lime Point property near Hornsilver.

Humboldt County—Seven Troughs

Kindergarten—After a shutdown lasting six weeks, due to a broken cam shaft the Kindergarten mill has resumed operations. It is now running on 100 tons of ore assaying $90 per ton that came from the Kindergarten mine.

Esmeralda County—Rawhide

Rawhide Tarantula—The Tarantula shaft is 120 ft. deep. Ore has been cut in a drift on the 85-ft. level. A hoisting plant will be installed.

Rawhide Coalition Mines—This company is contemplating the erection of a stamp-mill and cyanide plant. J. B. Fleming, who designed the 600-ton mill for the Goldfield Consolidated, has reported to the management on conditions and milling necessities. He recommends a 100-stamp mill built in units of 20 stamps each. Work on the first two units will be started soon.

Lincoln County—Crescent

Crescent Turquoise—Tiffany & Company of New York will re-open the turquoise mines at Old Crescent camp, which have not been operated for several months. The gems are mined within 15 ft. of the surface.

Storey County—Comstock

The production of the Comstock lode for the past week amounted to 414 tons valued at $15,000, besides 694 tons of second-class ore, which was sent to the Kinkead mill and to the Butters plant for treatment. The Ophir produced the largest part of the first-class ore which averaged between $40 and $42 per ton. The Consolidated Virginia produced 30 tons valued at $900 per ton.

Nye County—Tonopah

The ore production for the week was 5315 tons of an estimated value (shipping ore valued at $60 per ton and milling ore at $25 per ton) of $134,450. The Tonopah Mining Company mined 3200 tons; Belmont, 650 tons; Montana Tonopah, 620 tons; Midway, 100 tons; MacNamara, 350 tons; West End, 100 tons; Jim Butler, 250 tons; Tonopah Extension, 45 tons.

Belmont—The new vein, where it is crosscutted from the east drift on the 100-ft. level driven from the winze on the 1000-ft. level, is 38 ft. wide. Most of this width is milling ore; one sample representing a width of 6 ft. assayed $19 per ton. A crosscut from the west side of this winze has cut the same vein, and on this side also the vein contains ore of good milling grade.

Montana Tonopah—Drilling with the Calyx drill began this week, but was stopped owing to a break in the machinery, after a hole 5 ft. deep had been drilled Drilling will be resumed as soon as repairs can be made. The mine treated during the week 941 tons of ore, 322 of which came from the MacNamara.

Tonopah Extension—The north and south crosscuts on the 400-ft. level were advanced during the week, but no ore has been found as yet. Both these crosscuts are being run in virgin ground. At present the only development work being done on the 600-ft. level consists of sinking a winze on the vein found in the west drift. The principal prospecting work in the mine is being done on the 770-ft. level, where a long crosscut is being run toward the north in order to get under the winze which is being sunk from the 600-ft. level.

Jim Butler—On the 200-ft. level, work has been started on a new vein a few feet south of the one now being stoped. The vein shows 4 ft. of milling ore. The sinking of the Stone Cabin shaft has been discontinued for the present, as it has reached the proper depth for the cutting of a station at the 700-ft. level.

Tonopah Mining Company—Last week, 427 ft. of new ground was broken. The drill-hole in the Red Plume shaft was advanced 19 ft. so that now it is 344 ft. below the 500-ft. level.

Nye County—Manhattan

Rose-Nash Lease—After taking out from this lease on the Union No. 4 claim

a large amount of valuable ore, work was stopped some time ago. Recently when water was taken from these workings for placer operations on the Big Chief, the Rose-Nash people decided to sweep the old stopes. While doing this it was discovered that the vein, instead of pinching out, had simply changed its dip to about 45 deg. They now have a vein 4 ft. wide averaging $42 per ton.

NYE COUNTY—CLIFFORD

Broken Hills Mine—The returns from the first shipment of ore since the property was acquired by the J. C. McCormack Company, of Goldfield, show that the ore is worth $335 per ton as it assays 9.27 oz. gold and 293.44 oz. silver. The second shipment has been loaded on the cars at Tonopah; the mine assays indicate that this shipment will be of higher grade than the first one. Four 8-horse and two 6-horse teams are hauling the ore from Clifford to Tonopah. It is then shipped by rail to the mills at Millers. The wagon haul costs $20 per ton.

NYE COUNTY—BULLFROG

Montgomery Shoshone—Arrangements are being made to increase the capacity and equipment of the Shoshone mill by the addition of both a 6-ft. Chilean mill and a tube mill; the tube mill is for regrinding the concentrates which will be treated in the cyanide plant, thus eliminating the freight and smelting charges.

WHITE PINE COUNTY

Nevada Consolidated Copper Company—At the annual meeting S. W. Eccles, James Phillips, Jr., W. Hinkle Smith, F. W. Hills, Charles Hayden, C. Hartman Kahn, W. B. Thompson, J. K. MacGowan, Willard S. Morse, John N. Steele and W. E. Bennett were elected directors. James Phillips, Jr., president of the company, says that when the fifth unit is completed the annual production of copper will be 70,000,000 lb. blister copper. He stated that in January, 1909, the monthly output will be approximately 3,000,000 lb. Pope Yeatman recommends that another unit be added to the mill and smelter.

New Mexico

SOCORRO COUNTY

Mogollon Mountains—The only mining company paying dividends is the Ernestine Mining Company, but others are doing development work and opening up sufficient ore to justify the erection of a mill—quite an expense as the mines are far from the railroad. The properties of the Socorro Mines Company, and the Deadwood, Enterprise and Cooney mines are working and have considerable ore developed. At the Confidence mine considerable ore has been developed, but this mine is at present shut down. The Socorro Mines Company and the Enterprise Company are building mills. The Deadwood Company plans to build a mill this fall. As yet there is no custom mill in the district.

Texas

Petroleum production in the Southeast district in October, according to the figures collected by the *Oil Investors' Journal*, was 943,740 bbl. Shipments by rail for the month were 509,546 bbl.; by sea, 272,091; total, 781,637 bbl. This does not include refining or local consumption. There were 49 new wells completed in October, 43 finding oil, while six were dry holes. On Oct. 31 there were 95 new wells under drill.

LIBERTY COUNTY

A syndicate, represented by Dr. A. L. Lyons, of Liberty, has been engaged for some time in boring for sulphur on a tract of land near Liberty. A number of holes have been drilled, and it is said that the results indicate a large deposit of sulphur at a depth of about 300 ft. Arrangements are being made to open and develop this deposit.

Utah

JUAB COUNTY

Tintic Ore Shipments—Shipments for the week ending Nov. 5, amounted to 99 carloads. The Beck Tunnel shipped 2 cars; Colorado, 22; Bullion Beck, 3; Centennial Eureka, 40; Eagle & Blue Bell, 4; Uncle Sam Consolidated, 6; Yankee Consolidated, 3; Sioux Consolidated, 8; May Day, 2; Mammoth, 4; Eureka Hill, 2; Utah Consolidated (Tintic), 2.

Tintic Smeltery—One lead furnace is in commission at this plant, but the second one will likely be blown in within the next few days.

Sioux Consolidated—Conditions in this property are very encouraging; the management gives asurance that they are such as to justify an increase in the dividend this month, and again next month.

Utah-Nevada Development Company—The 100-ton concentrating mill in the west Tintic district is ready for operation. Leslie L. Savage, of Salt Lake, is the manager.

SALT LAKE COUNTY

Boston Consolidated—The copper production in October was 1,200,000 lb. The mill is now treating about 1500 tons of ore per day.

Utah Apex—This company is preparing to install a concentrating mill with capacity to treat 500 tons of ore a day. Robert S. Oliver, of Bingham Cañon is manager.

SUMMIT COUNTY

Park City Ore Shipments—Shipments for the week ending Nov. 5 amounted to 1655 tons. The Daly-Judge shipped 332 tons; Silver King Coalition, 748; Daly-West, 575 tons.

Park City Ore Shipments—The output last week was 1832 tons; the Silver King Coalition Company shipped 956; Daly-West, 575; Daly-Judge, 290.

Grasselli Chemical Company—The zinc concentrator at Park City owned by this corporation is running again after having been enlarged and improved. Middlings from the Daly-Judge mill are being treated.

TOOELE COUNTY

Lion Hill Consolidated—This company, operating on Lion Hill, in the Mercur district, has recently developed a shoot of high-grade silver ore at a point 1200 ft. from the portal of the adit through which the mine is being developed. Some samples assayed 1500 oz. silver per ton.

UTAH COUNTY

Mountain Dell—At this property, in the American Fork district, the adit run to intercept the orebody exposed in the upper workings has reached the objective point 500 ft. below the upper workings.

West Virginia

KANAWHA COUNTY

East Bank Coal Company—This company has been organized to develop a tract of coal land near East Bank. Edward Clark is president; S. I. Johnson, East Bank, treasurer.

MARION COUNTY

Haywood Coal Company—Pittsburg coal operators have bought the stock of this company and intend to reorganize it and enlarge the plant. E. F. Gwynn Pittsburg, Penn., is president; Seymour McIntyre, Fairmont, W. Va., vice-president.

MCDOWELL COUNTY

Buchanan Coal Company—This company has been organized to open a coal mine near Yukon. Its incorporators include L. C. Anderson, D. J. F. Strother and Louis Wilmore, all of Welch, W. Va.; George W Mullins, Ward, W. Va., and associates.

RANDOLPH COUNTY

Meadow Run Coal and Land Company—This company has been organized to open coal mines near Evanwood. The capital stock is $1,600,000, and the company is said to have secured control of 24,000 acres of land. Among the incorporators are Edward S. Jones, of Scranton, Penn., and T. W. Raine, of Evanwood.

Wisconsin

ZINC-LEAD DISTRICT

Big Four—This company is prospecting by drill on its land east of the Baxter.

Board of Trade—Employing a small crew of men this new producer is shipping a car of concentrates weekly, aver-

aging 57 per cent. zinc; the present force will be doubled during the coming month and the output of the mine doubled.

Cuba City—The Wisconsin Supreme Court has reversed the decision of the Circuit Court in the case of Trego against the Roosevelt Mining Company, whereby the Roosevelt company is relieved of indebtedness obligation for the Trego roaster; this roasting apparatus proved a failure and the Roosevelt Mining Company refused to make settlement on the grounds of breach of contract.

Dall—The new shaft has been sunk to the clay bed and a 12-ft. breast of high-grade jack is being opened up; 1000 ft. of tramway will connect this shaft with the mill. The company paid its second monthly dividend of 5 per cent. on Oct. 26.

Henrietta—This company is installing two new boilers and a compound condensing Prescott pump of 8-in. suction; the main shaft will be sunk deeper and the lower ore run followed.

Highland—The Lampe estate, comprising two 80-acre tracts of mining land, was sold at sheriff's sale Oct. 26 on judgment of partition; one tract was bid in by Lampe brothers at $10,000; the other was bid in by the same parties at $27,000, the Mineral Point Zinc Company bidding $25,000. The Lakey 10-acre tract was purchased recently for $5000 by the Mineral Point Zinc Company.

Kroll—Frank H. Kroll has opened up a rich vein of jack on his land 1½ miles south of the village; a 50-ton mill will be erected.

Pittsburg—This company joined the list of producers this week by sending its first car of concentrates, assaying 47 per cent. zinc to the Electrostatic Separator at Platteville.

Wallace—Ore from this mine is being treated at the mill of the Milwaukee Mineral Company; 300 tons of concentrates, assaying 57 per cent. zinc, are held for better prices.

Canada

Ontario—Cobalt District

Ore Shipments—Shipments of ore for the week ending Oct. 31 were as follows: Crown Reserve, 127,000 lb.; Cobalt Central, 43,600; Chambers-Ferland, 60,440; City of Cobalt, 42,000; Drummond, 100,000; Kerr Lake, 184,050; La Rose, 386,330; Nipissing, 187,260; Nova Scotia, 55,400; O'Brien, 190,370; Right of Way, 81,840; Temiskaming, 63,000; Temiskaming & Hudson Bay, 185,160; total, 1,706,690 pounds.

Foster-Cobalt—A statement has been issued to the shareholders of the company that at the next annual meeting, Nov. 4, the directors will report an available cash surplus above liabilities approximating $38,000, the decrease as compared with the statement at last annual meeting being due to cost of development work and operation.

Temiskaming & Hudson Bay—Several new discoveries have recently been made on the south lots near the Silver Queen and Right of Way properties. The new vein lately found on the Little Nipissing has been picked up. A shaft will be put down on one of the new veins which varies from 6 to 18 in. in width, and promises well. The main shaft is down 200 ft., and a station is being cut for the fourth level. On the second level 600 ft. of drifting and crosscutting has been done, including work on the new Tretheway vein, which runs a considerable distance on the Hudson Bay property, averaging 4 in. of rich ore. A crosscut 400 ft. in length has been driven north to a rich vein, and an upraise made connecting with the surface.

Quebec

Diamond Graphite Company—J. J. and Harold Tonkin, of New York, are developing the company's graphite deposit six miles from Buckingham. A carload of machinery has arrived.

Mexico

Chihuahua

Parral Output—The production of the Parral camp for the week ending Oct. 30 was 7930 tons, as compared with 7950 tons for the preceding seven days. The smelting ore produced during these two weeks was, respectively, 2480 and 2560 tons. The October output was a little less than that of September.

Southern Mining Company—This concern is resuming mining operations on a larger scale at its Marguerita mine in the Ocampo district. The president, Warren Barnett, of Birmingham, is now directing operations, and announces that a 60-ton cyanide plant is to be installed shortly.

American Smelting and Refining Company—The ore shipments from the Chihuahua sampling works during October exceeded 13,000 tons, the entire tonnage going to the company's El Paso smeltery. Preparations are also being made for the early blowing in of a third furnace at the Chihuahua plant.

Pennsylvania-Mexican—This company was lately organized by Pittsburg men on the basis of the properties of the Sahuayacan Mining Company and the adjoining Santa Teresa mine situated in the Rayon district. George E. Howard remains general manager of the new company.

Julimes—A promising lead-silver district is being exploited in the vicinity of this place along the Conchos river in the eastern part of the State. A recent carlot shipment sent out by Charles Moffat, of Chihuahua, ran about 45 oz. silver and 60 per cent. lead. Some parts of the region were worked by Mexicans 15 years ago. As the region is now more accessible from the line of the Orient railroad, it is anticipated that several mines may be profitably worked.

Solis—A milling plant is being set up at this old property in the Otates section to the west of Chihuahua. The manager in charge is R. C. Harper, of San Francisco.

Guanajuato

Production—The shipments for the week ending Nov. 1 amounted to $115,000 in ores and concentrates and $180,000 in bullion, a falling off of $2000 as compared with the preceding week. The Dwight Furness Company shipped ores and concentrates to the amount of $82,000. Practically all of the ore shipped was sent to the Aguascalientes smelting works.

Jalisco

Magistral—This mine in the Ameca district has been extensively developed while under bond to James P. Harvey. Arrangements are being made for the erection of a reduction plant having a daily capacity of 100 tons.

Casados—This mine in the Hostotipaquillo district has been developed well below the old Spanish workings and rich ore has been found. Bids are being received on a 20-stamp mill, concentrators and a cyanide plant. W. R. Ramsdell is president of the Consolidated Mining Company which owns the Casados mines.

San Luis Potosi

Mazapil Copper Company—The Saltillo smelter of the company is erecting an additional furnace.

Sonora

Moctezuma—This company is about to quadruple its output after two years of development work. Mine and surface machinery have been installed, a railroad to connect the mines built, and concentrating and smelting apparatus set up. The company expects to increase its output during the next year to 30,000,000 lb. of copper.

San Antonio Copper Company—This company has been formed at Iron Mountain, Mich., to develop 2000 acres of mineral land near the village of San Antonio de la Huerta, district of Ures. There are nine mining claims, and development has been in progress for two years. The body of copper ore is opened by means of adits. The company has a capitalization of $2,500,000, and is a close corporation.

Territorio de Tepic

Certuchena y Anexas—These mines are reported to have been purchased in behalf of Epes Randolph and associates. J. P. Casey, of El Paso, will have charge of the property, and the plans include the installation of a hydroelectric plant to develop power for mining and milling. The property is only a few miles from the line of the new Southern Pacific extension.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Nov. 11—Coal trade in the West seems to have taken a turn for the better. While domestic sales are kept down by continued mild weather, a better demand for steam coal is manifest. Orders received by mines are on the increase, and operators feel encouraged. The exception is in the Pittsburg district, where matters are still dull.

The Seaboard bituminous market is still rather quiet, but there are some signs of a better demand. This is especially manifest in New England territory. The Coastwise trade is fairly active.

The anthracite trade has been held back by high temperatures. For the next month or so it will be essentially a weather market.

The coke trade is reviving and production increasing. This depends entirely upon the iron market, and larger coke shipments are the first sign of greater iron production.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Oct. 31, in short tons:

	1907.	1908.	Changes.
Anthracite	4,737,236	4,285,312	D. 451,924
Bituminous	32,925,455	27,854,121	D. 5,071,334
Coke	11,780,263	5,791,558	D. 5,988,705
Total	49,442,954	37,930,991	D. 11,511,963

The total decrease this year to date was 23.3 per cent.

Shipments of anthracite coal from Buffalo by Lake for the season to Nov. 1 were 2,865,585 tons in 1907, and 3,490,770 in 1908; increase, 625,985 tons..

Anthracite coal shipments in October were 5,977,497 long tons, being 766,450 tons more than in September, but 130,568 tons less than in October, 1907. For the 10 months ended Oct. 31 the shipments were, in long tons:

	1907.	1908.	Changes.
Reading	11,658,568	10,089,009	D. 1,569,559
Lehigh Valley	9,648,455	9,007,476	D. 640,979
N. J. Central	7,209,362	6,945,430	D. 263,932
Lackawanna	8,625,262	8,245,273	D. 379,989
Del. & Hudson	5,503,502	5,283,699	D. 219,803
Pennsylvania	5,142,468	4,941,169	D. 201,299
Erie	5,975,884	6,152,997	I. 177,113
N. Y., Ont. & West.	2,258,893	2,332,532	I. 73,639
Total	56,022,394	52,997,585	D. 3,024,809

Only two companies—the Erie and the New York, Ontario & Western—show increases. The Reading had the largest decrease—13.5 per cent. The total decrease this year was 5.4 per cent.

Coal passing through Sault Ste. Marie canals, season to Nov. 1, short tons:

	1907.	1908.	Changes.
Anthracite	1,260,074	1,124,019	D. 136,055
Bituminous	8,626,220	7,310,621	D. 1,315,599
Total	9,886,294	8,434,640	D. 1,451,654

Total decrease this year was 14.7 per cent.

Coal receipts at Boston, 10 months ended Oct. 31, long tons; reported by Chamber of Commerce:

	1907.	1908.	Changes.
Anthracite	1,705,535	1,464,123	D. 241,412
Bituminous	2,585,289	2,652,641	I. 67,352
Total domestic	4,290,824	4,116,764	D. 174,060
Foreign	448,137	312,348	D. 135,789
Total	4,738,961	4,429,112	D. 309,849

The foreign coal receipts are chiefly from Nova Scotia.

New York

Anthracite

Nov. 11—The tidewater market for both prepared and small steam sizes is again flat, after a short flurry of activity during the cold snap last week. All-rail trade, however, continues good and coal is in fair demand.

Schedule prices are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam prices are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50. All prices are f.o.b. New York harbor points.

Bituminous

These seems to be an improvement throughout all consuming territories, even in New York harbor. The demand is more real and factories show a disposition to take coal more readily. In New York harbor some dealers report a noticeable improvement, but others have not felt the increased demand. Coal companies selling their own product report better conditions than commission merchants. From the mines reports come that work is being increased and the mines are operating more days a week. Good grades of steam coal fetch $2.45@2.65 per ton in New York harbor. Transportation is good and cars are plentiful.

The better market is reflected in the Coastwise vessel trade. Vessels are scarce and in good demand. Freight rates are firm and higher than last week; the rates to the East on small vessels from New York harbor are the same as for large vessels from Philadelphia. The rates from the last-named point are as follows: To Boston, Salem and Portland, 70c.; Lynn, Newburyport and Bath, 75@80c.; Portsmouth, 75c.; Bangor, $1; Providence, New Bedford and the Sound, 60c. per ton.

Birmingham

Nov. 9—Coal production in Alabama is holding up well. The railroads are beginning to feel an improvement in all directions and their requirements will take up a large quantity of coal.

Coke is still in demand. All ovens are either in operation or being prepared for operation.

Chicago

Nov. 10—Overshipments in general have caused the wholesale coal market to be depressed in the last week. In the absence of cold weather domestic coals do not increase sales. The old condition, from which Chicago has been reasonably free for the last year, of this market's receiving coal for which there was not a clear market elsewhere, seems to have returned. Prices on Eastern and Western coals alike have been generally cut in the last week.

Illinois and Indiana coals are weak as regards fine coals, and domestic coals are moving slowly. Lump and egg bring $1.80@2.65, the best grades being frequently sold 25c. under the highest named price; run-of-mine $1.65@1.85 on most sales and screenings have been down to 95c., with $1.45 obtained on the highest lots.

Smokeless run-of-mine has sold at greatly varying prices and is quoted now at $1@1.25 at the mines for Pocahontas and New River, making the local price $3.05@3.30, though selling frequently at 25c.@35c. less, and with some smokeless run-of-mine as low as 60c. at the mines. Hocking has sold at 25c. in some cases under the circular price of $3.15 and Youghiogheny runs steadily on contracts at $3.15 for ¾-in. gas. Anthracite is selling fairly well in city and country.

Indianapolis

Nov. 9—That there is renewed activity at the principal mines is apparent. Already the iron industries are ordering coal and coke in large quantities and from many centers comes the report of preparation for more extensive operation of industrial plants. The car shortage predicted by December is already here with some of the roads. The coal-carrying roads are gathering in their empty cars to fill the demand. These roads expect to handle a large tonage of Indiana coal during this and next month. Several mines that closed down recently are preparing to start up, and it is predicted that within a few weeks nearly every mine in the State will be in operation.

Pittsburg

Nov. 10—The railroad mines in the Pittsburg district are being operated at about 50 per cent. of capacity; all of the river mines are idle owing to low water. Fully 40,000,000 bushels of coal are loaded in the pools and harbor ready to go to Southern ports on the next rise in the rivers. Coal is still being shipped to the Northwest. The principal shipper from this district is the Pittsburg-Buffalo Company, which is operating all of its mines. Its product is being handled by the M. A. Hanna Company. Prices are still quoted on a basis of $1.15 a ton at the mine for mine-run coal. Slack has advanced, and the lowest quotation is 75c. per ton.

Connellsville Coke—Coke conditions continue to improve, and prices are firmer. It is not unlikely that a stiff advance will be ordered before Jan. 1. For furnace coke $2 is regarded as the minimum for both prompt shipment and on contract. On foundry coke less than $2.25 cannot be done for any delivery. One large producer is asking $2.50 for deliveries running through the entire year. A scarcity of water and shortage of workmen is interfering with production, but not sufficiently to prevent supplying the present demand. Last week fully 1200 foreigners who went home when the depression began last fall have returned to the region. The *Courier* gives production in both fields at 223,987 tons. The shipments were 7961 cars as follows: To Pittsburg district, 3095; to points west of Pittsburg, 4372; to points east of Connellsville, 494 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, nine months ended Sept. 30, long tons:

	1907.	1908.	Changes.
Anthracite	2,076,541	2,054,906	D. 21,635
Bituminous	7,742,602	6,574,777	D. 1,167,825
Total coal	9,819,143	8,629,683	D. 1,189,460
Coke	682,583	450,125	D. 232,458

Canada took this year 6,940,150 tons of coal, or 80 per cent. of the total. Coal furnished to steamships in foreign trade is not included above.

United States Coal Imports—Imports of coal and coke into the United States, nine months ended Sept. 30, long tons:

	1907.	1908.	Changes.
Anthracite	132	15,023	I. 14,891
Bituminous	1,514,156	1,142,956	D. 371,200
Total coal	1,514,288	1,157,979	D. 356,309
Coke	100,442	87,647	D. 12,795

Canada furnished this year 807,565 tons coal, and nearly all the coke; Australia, 297,559 tons coal. Imports are chiefly on the Pacific Coast.

Coal in Bosnia—Coal production in Bosnia—including Herzegovina—in 1907, was 621,000 metric tons, all brown coal, or lignite. The output has increased largely since the provinces have been under Austrian rule.

Welsh Coal Market—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of Welsh coal as follows, on Oct. 31: Best Welsh steam, $3.66; seconds, $3.54; thirds, $3.30; dry coals, $3.60; best Monmouthshire, $3.24; seconds, $3.06; best small steam, $1.86; seconds, $1.56. All per long ton, f.o.b. shipping point.

Iron Trade Review

New York, Nov. 11—A revival in trade has apparently begun, though it is, perhaps, too soon yet to say how far it will go. At any rate, the waiting position, so long held, is disappearing, and there is a general disposition to place orders farther ahead.

In pig iron there has been a good deal of business done in lots of fair size, and some contracting for deliveries to go over the first quarter of 1909. This has stiffened prices and stopped concession. Southern pig is especially firm, the larger companies claiming that they are well supplied with orders. Sales include both foundry and basic pig.

In finished material structural steel has the call. Some large building contracts have been placed and others are coming forward. Several contracts for new cars are reported placed; otherwise the railroads are still buying little. The strength shown so far comes entirely from the general market.

Increased demand is reported for nails, wire and other small products, indicating an extension in smaller building operations and in general work.

Pig Iron Production—Reports from the blast furnaces on Nov. 1 show 200 coke and anthracite furnaces in blast, having an aggregate capacity of 362,700 tons weekly; an increase of 24,700 tons over Oct. 1. Taking the estimate of the *Iron Age*, and making allowance for the charcoal furnaces, the approximate production of pig iron in October was 1,578,500 long tons. For the 10 months ended Oct. 31 it was 12,529,500 tons. This includes the statement of the American Iron and Steel Association for the first half of the year.

Baltimore

Nov. 9—Imports for the week included 100 tons spiegeleisen, 1976 tons ferromanganese and 50 tons silicospiegel from England and Germany; 1921 tons cupreous pyrites from Spain, and 10,170 tons iron ore from Cuba.

Birmingham

Nov. 9—Southern manufacturers of pig iron are selling their product right along. Within the past week 50,000 tons of iron have been sold, delivery to be made during the first quarter of the coming year; prices for this iron were around $13 per ton, No. 2 foundry. It is stated that there has been no iron sold at $12.50. A number of inquiries have been coming in. Manufacturers in this district assert that they will be able to care for all the business that is offered. Quotations may improve in the next few days, though the producers oppose a jump in the market, believing that more will be gained through a steady improvement.

Cast-iron pipe makers are bidding on some large contracts, and it is stated that new orders are in hand now or in sight. More men are being given employment at the Ensley steel works of the Tennessee company and the production will increase right along.

The make of pig in this district will hardly be increased until after a good rainfall, there being a shortage of water noted. The Sloss-Sheffield company has one furnace ready for operation but water is needed in the orefields for washers.

Chicago

Nov. 19—Since election the iron market has shown increased strength in the number and size of orders for pig iron and in the sales of iron and steel products. There has, however, been no great change. Melters show an interest in possible deliveries for the first half of 1909, and are buying more freely iron for delivery in the first quarter. One large sale to an agricultural-implement manufacturing company has been supplemented by a number of sales ranging up to 500 tons; a few have gone higher. The average melter of pig iron is yet feeling his way.

Southern iron remains $12.50@13 Birmingham ($16.85@17.35 Chicago), with the higher price ruling. Northern is firm at $16.50@17, with the demand good at the higher figure. Higher prices are asked for delivery more than three months hence.

In iron and steel products the trade shows greater strength and firmness. Coke is in increasing demand and firm at $4.90 for best Connellsville.

Cleveland

Nov. 9—The movement of iron ore down the Lake in October was the largest for any month this season. Details are not yet reported, but the total was 5,099,110 tons, making a total of 21,730,070 tons to Nov. 1. The boats belonging to the big companies are nearly all in service still, and it is quite possible that there will be a big movement in November.

Philadelphia

Nov. 11—The feature of the market is the number of inquiries and orders for early delivery. A sudden interest has been developed in deliveries for next year. A hardening of prices has also taken place and concessions not to be had this week. The peculiar feature of the market is

the buying for anticipated wants. There is no present purpose to advance prices openly, but buyers of No. 2X for next quarter's delivery find that $16.25 delivered is the inside limit. It is ascertained that some business from this territory has gone to Virginia and Alabama, and that more is in negotiation. Basic pig is strong.

Steel Billets—Small sales for early delivery were closed today.

Bars—A stronger turn is apparent, and store prices for spot delivery have been advanced 0.1c. Mill men have made no advances.

Sheets—A better business is reported, both at stores and mills.

Pipes and Tubes—The industries using tubes have turned the corner. Negotiations were opened this week for tubes to be delivered next year.

Merchant Steel—Merchant steel met with a sudden demand in a small way.

Plates—Inquiries are on the market and it is known that certain large buyers are willing to place contracts at an early day if certain prices are named.

Structural Material—New enterprises have suddenly opened up. Only small sales have been made to builders in this territory. Car builders, ship builders and bridge builders are all on the stir.

Steel Rails—The only orders are for light rails and for traction roads.

Scrap—Nearly all kinds of scrap are beginning to move better than for months.

Pittsburg

Nov. 10—The feature of the iron and steel markets this week is the stiff advance in pig-iron prices by the producers. In finished-steel lines there is an improvement in new business, but the bulk of the orders are for small tonnages. The largest tonnage booked by the Carnegie Steel Company calls for 18,000 tons of plates. This order came through the dissolving of the injunction in the New York courts against the T. A. Gillespie Company, of Pittsburg, which had been given the contract for laying a pipe line on Long Island for supplying the borough of Brooklyn with water from its new reservoir. The contract calls for 16 miles of 72-in. steel pipe. The Carnegie company also has taken a number of other orders for plates and shapes, and a little new business in steel rails is being placed. The railroads, however, have not come into the market for 1909 requirements. It is believed this business will be placed soon. There is no truth in the report widely circulated that the railmakers have agreed to cut the present price of $28 to $24 a ton. It is possible that, to induce the early placing of rail business, the producers may make some concessions from the schedule issued several months ago basing prices on the percentage of discard from the ingot. Production at a number of mills in this district has increased during the week. The American Sheet and Tin Plate Company has increased its active tinplate mills to 116 and sheet mills to 99. At the bi-monthly examination of the bar-iron sales sheets under the sliding scale of the Amalgamated association, the average of sales for September and October was found to be 1.30c., the same as at the last examination; the puddlers will continue to receive $5.25 a ton and the pay of the finishers also remains unchanged. The bi-monthly examination on sheets and tinplate will be made later in the week.

Pig Iron—Within the past few days prices of all grades of pig iron have been advanced $1 a ton, the latest advance being 50c. ordered today by the furnace interests. As told in the last report, the Massillon Iron and Steel Company had an inquiry in the market for 27,000 tons of Nos. 2, 3 and 4 foundry iron. Representatives of a number of furnaces went to Massillon on Wednesday and presented figures which were higher than on the day preceding the election. As a result the company decided to defer placing the contract. The Westinghouse Electric and Manufacturing Company was in the market for 12,000 tons of different grades of foundry iron, but brought only 5000 tons. Sales in the past few days were for lots ranging from 100 to 500 tons, and at prices prevailing before the advance of 50c. a ton today. One interest sold 500 tons of No. 2 foundry yesterday, part at $15.25 and part at $15.75. It is reported that a sale of standard bessemer was made today at $16, but the report is not generally credited. Pig-iron quotations for delivery the rest of this year and for the first quarter announced today are as follows: Bessemer, $15.50@16; malleable bessemer, $15.50; basic, $15; No. 2 foundry, $15.50@16; gray forge, $14.50; all f.o.b. Valley furnaces. These are merely quotations, and are not based on actual sales.

Steel—The market seems a trifle stronger for billets, but no important transactions are recorded. Both bessemer and open-hearth billets are quoted at $25; sheet-bars and tin-bars at $27.50, Pittsburg. Merchant-steel bars remain at 1.40c. and plates at 1.60 cents.

Sheets—There is but little change in the sheet trade. Prices are firm, all shading having been stopped. Black sheets are quoted at 2.50c., and galvanized at 3.55c. for No. 28 gage.

Ferro-manganese—Prices are firm at $46@46.50, Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the nine months ended Sept. 30, are valued by the Bureau of Statistics of the Department of Commerce and Labor at $146,230,407 in 1907, and $115,430,368 in 1908; a decrease of $30,800,039, or 21.1 per cent. Leading items of export, in long tons:

	1907.	1908.	Changes.
Pig Iron	60,109	30,568	D. 29,541
Billets, ingots & blooms	60,293	86,315	I. 26,022
Bars	75,160	38,252	D. 36,908
Rails	253,249	156,098	D. 97,151
Sheets and plates	92,450	75,731	D. 16,719
Structural steel	102,187	91,448	D. 10,739
Wire	116,325	99,546	D. 16,779
Nails and spikes	45,649	29,356	D. 16,293

Decreases are shown in all items except billets, ingots and blooms.

Iron and Steel Imports—Imports of iron and steel, including machinery, into the United States for the nine months ended Sept. 30 were valued at $31,697,879 in 1907, and $14,923,195 in 1908; a decrease of $16,774,684, or 52.9 per cent. Leading items of imports, long tons:

	1907.	1908.	Changes.
Pig iron	449,147	65,280	D. 383,867
Scrap	24,969	3,666	D. 21,303
Ingots, blooms, etc.	11,465	7,237	D. 4,228
Bars	30,341	15,03[illegible]	D. 15,306
Wire-rods	13,299	8,570	D. 4,729
Tinplates	46,706	49,712	I. 3,006

Decreases are shown here in all the items except tinplates.

Iron Ore Movement—Exports and imports of iron ore in the United States for the nine months ended Sept. 30 are reported as follows, in long tons:

	1907.	1908.	Changes.
Exports	158,243	191,408	I. 33,165
Imports	972,340	482,908	D. 489,432

Of the imports this year 393,108 tons came from Cuba. Imports of manganese ore for the nine months, 142,120 long tons in 1907, and 134,240 in 1908; decrease, 7880 tons.

Foreign Iron Trade

German Pig Iron Production—The German Iron and Steel Union reports the pig-iron output of Germany in September at 928,729 metric tons, a decrease of 6716 tons from August. For the nine months ended Sept. 30 the total was, in metric tons:

	1907.	1908.	Changes.
Foundry iron	1,668,083	1,668,587	I. 504
Forge iron	583,494	495,194	D. 88,300
Steel pig	758,732	704,940	D. 53,792
Bessemer pig	357,461	297,039	D. 60,422
Thomas(basic)pig	6,320,714	5,758,905	D. 661,809
Total	9,688,484	8,924,665	D. 763,819

Steel pig includes spiegeleisen, ferro-manganese, ferro-silicon and all similar alloys. The total decrease this year was 7.9 per cent.

German Iron Trade—Imports and exports of iron and steel in Germany, nine months ended Sept. 30, metric tons:

Imports:	1907.	1908.	Changes.
Iron and steel	600,063	429,696	D. 170,367
Machinery	72,713	63,342	D. 9,371
Total	672,776	493,038	D. 179,738
Exports:			
Iron and steel	2,569,880	2,751,541	I. 181,661
Machinery	242,849	271,908	I. 29,059
Total	2,812,729	3,023,449	I. 210,720

The increase in exports is comparatively small, though efforts have been made to push foreign trade.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Nov. 11.
At all U. S. Ports in September and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Sept. 1908..	$ 3,974,391	$ 4,695,894	Imp.$ 721,503
" 1907..	1,503,836	2,759,019	" 1,255,183
Year 1908..	68,937,380	38,356,816	Exp. 30,580,564
" 1907..	49,879,813	30,862,220	" 19,017,593
Silver:			
Sept. 1908..	4,198,286	3,303,362	Exp. 894,924
" 1907..	6,048,457	3,822,766	" 2,225,691
Year 1908..	38,781,380	30,725,475	" 8,055,905
" 1907..	47,970,793	34,488,224	" 13,482,569

Exports of specie from New York week ended Nov. 7: Gold, $125; silver, $768,335, to London and Paris. Imports: Gold, $191,442, from Cuba and South America; silver, $146,136, from Mexico and the West Indies.

Silver

SILVER AND STERLING EXCHANGE.

Nov.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Nov.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
5	4.8600	49⅝	22 1/16	9	4.8588	49⅝	22 1/16
6	4.8590	50⅛	23⅛	10	4.8565	49⅞	23 1/16
7	4.8575	50	23⅛	11	4.8575	50⅛	23 1/16

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

The silver market has been forced down by enormous speculative bear sales of futures. This has unsettled the market very materially; while on the other hand, speculative purchases of spot metal have tended to check the fall that, from the London point of view, seemed certain.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Oct. 29:

	1907.	1908.	Changes.
India.....	£9,899,954	£8,171,813	D. £1,728,141
China.....	99,850	516,400	I. 416,550
Straits.....	625,950	164,885	D. 461,065
Total.....	£10,625,754	£8,853,098	D. £1,772,656

Imports for the week, £5000 from Mexico and £190,000 from New York; £195,000 in all. Exports, £739,000 to India.

Copper, Tin, Lead and Zinc

Nov.	Copper. Lake, Cts. per lb	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
5	14⅛ @14¼	13⅞ @14	62 1/16	30½	4.35 @4.40	4.90 @4.95	4.75 @4.80
6	14¼ @14⅜	14 @14⅛	63 1/16	30¾	4.35 @4.40	4.95 @5.00	4.80 @4.85
7	14¼ @14½	14 @14¼	....	30⅞	4.35 @4.40	4.95 @5.00	4.80 @4.85
9	14⅜ @14⅝	14⅛ @14⅜	64⅞	31¼	4.35 @4.40	4.97½ @5.02½	4.82½ @4.87½
10	14⅜ @14¾	14⅛ @14⅜	64 1/16	31	4.35 @4.40	5.00 @5.05	4.85 @4.90
11	14⅜ @14¾	14⅛ @14⅜	64 1/16	30¾	4.35 @4.40	5.00 @5.05	4.85 @4.90

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The election of Mr. Taft was followed by an enormous buying movement in copper, both for domestic consumption and for export. Manufacturers in this country received large orders for finished material and came into the market for deliveries over the next four months. The demand that developed from Europe was surprisingly good in view of the large quantities of copper that Europe has absorbed during the last 12 months, and it appears that comparatively little of this copper has gone into stock as buyers have recently been in the market for early deliveries. The business done since Nov. 4 has apparently amounted in the aggregate to about 75,000,000 lb., in which both American and European manufacturers have participated, together with some speculative accounts. European manufacturers, as well as the American appear to have been awaiting the result of the election. The major part of the business was done previous to Nov. 9, since when there has been a relaxation, although quotations have risen under the buying by belated manufacturers. The Calumet & Hecla was a seller in the early part of the week, but since then appears to have withdrawn from the market for Lake, which has consequently been left to the outside producers, who toward the close realized as high as 14¾c. from domestic manufacturers for the fancy brands, while other brands were still obtainable at 14½c. Producers of electrolytic copper have been large sellers throughout the week, on an advancing scale of prices; but since Monday electrolytic has been freely offered, in million-pound quantities at 14⅜c., cash, and 14½c., delivered 30 days, which is the equivalent of 14⅜c. cash, while in some quarters offers have been made at a slightly lower price. For deliveries after the first of January the views of sellers appear to be somewhat higher. The market closes strong at 14½@14¾c. for Lake copper; 14¼@14⅜c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 13⅞@14⅛c., closing higher.

The London market for standard copper experienced a volume of business such as has not taken place in a long time. Orders poured in there from all over the world, and the market rapidly advanced, at one time touching £66 5s. for three months. Toward the end of the week there was a reaction, and the market closes at £64 11s. 3d. for spot, £65 10s. for three months.

Refined and manufactured sorts we quote: English tough, £68 10s.; best selected, £67 10s.@£68 10s.; strong sheets, £79 10s.@£80 10s.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. Wire, 15¾c. base, carload lots at mill.

Tin—The London market during the past week, in sympathy with copper, has shown a good deal of strength and large transactions have taken place. At the beginning of this week quotations showed a maximum advance of almost £5, being cabled as £142 for spot, £143 10s. for three months. The close is easier at £139 5s. for spot, £140 17s. 6d. for three months.

Business in this market was satisfactory, and especially was more interest shown among consumers. At the close the market is quoted about 30¾ cents.

Lead—A fair business has been doing from day to day at last prices, and lead at New York continues to be quoted at 4.35 @4.40 cents.

The market for Spanish lead in London has considerably improved and closes at £13 17s. 6d. with English lead at £14 per ton.

Spelter—Has been strong and advancing, due not so much to a large demand, as to the fact that the stock of metal has been reduced and the price of ore is such that smelters have had to raise their price for the metal. Up to Saturday there were some substantial sales of the metal, but since then the market has been less active. At the close spelter at St. Louis is quoted 4.85@4.90c., New York at 5@5.05 cents.

The London market for spelter is also strong and advancing, good ordinaries being quoted at £21, specials £21 5s. per ton.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Negotiations to establish an international convention among the zinc smelters of Europe are still in progress.

Other Metals

Antimony—A good demand and considerable speculative interest have resulted in substantial sales. Quotations are 8¼c. for Cookson's, 8@8¼c. for Hallett's, and 7¾@8c. for ordinary brands.

Aluminum—The nominal price of the American producer is still 25½c. per lb., but high-grade foreign aluminum has been freely offered at 22½c. We quote 22½@25½c.

Quicksilver—In New York trade is fair, with no change in prices, $46@47 per flask being quoted. San Francisco, $44@45 for domestic orders, $42@43 for export. London, £8 10s. per flask.

Platinum—Business with jewelers continues good, and the electrical demand has taken a sharp, upward turn. Prices are higher, dealers quoting 23@23.50c. for ordinary platinum, 25.50@26c. for hard, and 18.50c. for scrap.

Nickel—Large lots, 40c., New York.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Imports and Exports of Metals

Exports and imports of metals in the United States for the nine months ended Sept. 30 are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	236,988	62,757	Exp. 174,231
Copper, 1907....	130,510	90,336	Exp. 40,174
Tin, long tons....	183	26,478	Imp. 26,293
Tin, 1907.....	483	31,156	Imp. 30,673
Lead, short tons.	54,659	81,242	Imp. 26,583
Lead, 1907.....	35,684	55,585	Imp. 19,901
Spelter, sh. tons.	2,278	823	Exp. 1,455
Spelter, 1907....	393	1,316	Imp. 923
Nickel, lb.....	8,026,950	13,390,285	Imp. 5,363,335
Nickel, 1907....	6,979,881	13,815,477	Imp. 6,835,596
Antimony, lb.	.....	5,786,121	Imp. 5,786,121
Antimony, 1907.	.....	6,160,060	Imp. 6,160,060
Platinum, oz.....	.....	24,978	Imp. 24,978
Platinum, 1907.	.....	57,588	Imp. 57,588
Quicksilver, lb...	185,089	.....	Exp. 185,089
Quicksilver, '07	345,297	.....	Exp. 345,297
Aluminum, value	$285,711	.....	Exp. $285,711
Aluminum, 1907	259,984	.....	Exp. 259,984
Ores, etc.:			
Zinc dross, lb....13,555,081	.....		Exp.13,555,081
Zinc dross, '07..16,520,771	.....		Exp.16,520,771
Zinc ores, lg.tons	21,056	37,157	Imp. 16,101
Zinc ores, 1907.	13,991	.....	.....
Antim'y ores, lb.		1,731,709	Imp. 1,731,709
Ant. ores, 1907.		2,475,348	Imp. 2,475,348

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include re-exports of foreign material. Zinc ores imported this year included 18,452 tons calamine and 18,705 tons other ores; not reported last year.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 7—This week $37 was the highest price paid for zinc ore on a basis of $36@37 per ton of 60 per cent. zinc. For 80 per cent. lead ore, $54 per ton was paid.

Shipments, week ended Nov. 7:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	472,195	.....	210,000
Benton.....	394,540	120,500	.....
Harker.....	345,880	.....	.....
Highland.....	282,900	65,000	.....
Hazel Green	279,200	.....	.....
Linden.....	190,630	.....	.....
Cuba City	161,000	49,000	.....
Livingston	112,000	.....	.....
Days Siding.....	85,000	.....	.....
Mineral Point...	33,000	.....	.....
Total.....	2,356,345	234,500	210,000
Year to Nov. 7.....93,090,209		9,248,605	3,404,604

In addition to the above there was shipped to the Platteville Separating Company, 595,450 lb.; to the Joplin Separator Works, 333,900 lb.; to the Enterprise roaster, 255,000 lb. zinc concentrates.

Joplin, Mo., Nov. 7—The highest price paid for zinc blende was $40, the highest assay base price was $37.50 per ton of 60 per cent. zinc, ranging down to $36. Zinc silicate sold on a base price of $18 per ton of 40 per cent. zinc. The average price, all grades, was $32.84 per ton. The highest price paid for lead ore was $58, ranging down to $53 early in the week, and the average price, all grades, was $54.94 per ton.

Market conditions were stronger, and there were unverified reports of $38 base for zinc blende and $60 for lead ore. So far as could be learned these were merely the anticipations of producers. Buying has been unusually strong for three weeks, and a heavier shipment is reducing the stock on hand, now approximately 7000 tons. Nearly half this is old stock that has been held more than a year for higher prices.

SHIPMENTS, WEEK ENDED NOV. 7

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	2,750,610	602,720	$63,334
Joplin.....	2,012,820	343,560	45,023
Alba-Neck.....	913,310	41,080	16,654
Miami	438,800	360,660	14,305
Spurgeon.....	697,800	130,800	13,738
Galena	471,000	84,670	10,135
Badger.....	522,990	.....	9,513
Prosperity.....	287,680	105,730	7,795
Duenweg.....	307,130	83,190	7,507
Granby	492,800	33,500	7,350
Aurora.....	434,800	34,580	7,079
Carthage.....	251,850	.....	4,532
Zincite.....	151,190	2,760	2,795
Oronogo.....	70,380	.....	1,302
Sarcoxie.....	64,820	.....	1,166
Cave Springs.....	62,210	.....	1,057
Quapaw.....	63,980	.....	959
Wentworth.....	47,910	.....	559
Totals	10,042,080	1,823,250	$214,803
45 weeks.....	433,040,930	66,488,800	$9,117,720

Zinc value, the week, $164,710; 45 weeks, $7,288,145
Lead value, the week, 50,093; 45 weeks, 1,829,575

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price. 1907.	1908.	Zinc Ore. All Ores. 1907.	1908.	Lead Ore. All Ores. 1907.	1908.
January.....	$46.90	$37.60	$45.84	$35.56	$83.58	$46.88
February....	48.30	36.63	47.11	34.92	84.58	49.72
March.....	49.75	36.19	48.66	34.19	82.75	49.90
April	49.25	35.40	48.24	34.08	79.76	52.47
May	46.90	34.19	45.98	33.39	79.56	56.05
June.....	47.00	33.06	44.82	32.07	73.66	60.48
July	46.80	34.55	45.79	31.67	58.18	59.90
August	44.56	36.53	43.22	33.42	59.54	60 34
September ..	41.00	37.63	40.11	34.44	53.52	54.59
October.....	41.75	35.95	39.83	33.28	51.40	52.63
November...	38.60	.....	35.19	.....	43.40	.....
December...	31.50	.....	30.87	.....	37.71	.....
Year.....	$44.36	.....	$43.68	.....	$68.90	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Nov. 11—The general trade shows improvement along lines used for manufacturing purposes. Drug chemicals, not having suffered materially during the recent depression, are unchanged. A cut in the prices of bichromates, both potassium and sodium, was announced this week. The potassium salt is now quoted at 8⅜c. and sodium bichromate, 6½c. The former prices were 8⅝@9c. and 7⅛@7½c. per lb. respectively.

Copper Sulphate—The strength of the copper metal market has affected the sulphate market only in withdrawing cheap goods. Standard salt remains unchanged at $4.65 per 100 lb. for carloads, and up to $4.90 for smaller lots.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on Nov. 1 as follows, in long tons:

	1907.	1908.	Changes.
Stocks, Jan. 1.....	13,050	5,900	D. 7,150
Imports, 10 months....	266,845	242,950	D. 23,895
Total Supplies.....	279,895	248,850	D. 31,045
Deliveries, 10 months..	269,095	235,850	D. 33,245
Stocks, Nov. 1.....	10,800	13,000	I. 2,200
Afloat for U. S. ports....	65,000	60,000	D. 5,000

Quantities afloat include all cargoes due to arrive at United States ports by Feb. 15 next.

Phosphates—Paul C. Trenholm reports shipments of phosphate rock from Charleston, S. C., in October as follows: By sea to Richmond, Va., 500 tons; to Baltimore, 1101; by rail, 6222; total, 7823 long tons.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States nine months ended Sept. 30 were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	7,025,444	E.	7,025,444
Bleach, lb.....	53,486,830	80,031	I. 53,406,799
Potash salts, lb..	167,863,795	814,835	I. 167,048,960
Soda salts, lb....	8,710,874	548,337	I. 8,162,537
Acetate lime, lb.	45,909,660	E.	45,909,600
Nit. of soda, tons	222,392	6,667	I. 215,725
Phosphates, tons	20,177	1,010,274	E. 990,097
Sulphur, tons....	17,906	19,491	E. 1,585
Pyrites, tons.....	503,296	.....	I. 503,296

Estimating sulphur contents of pyrites, the total sulphur imported was approximately 219,224 long tons.

Mining Stocks

New York, Nov. 11—The rise in the general stock market which set in last week continued for several days, with heavy sales, the Exchange being quite excited at times. On Nov. 9, however, there was a reaction, largely to profit taking by some large interests. The market stood up fairly well under this process, and stocks were freely absorbed. Apparently the reaction has nearly run its course today, and quotations are improving at the close. There are signs also of outside buying of many stocks. Utah Copper was especially active, making a high point at $53, with some loss at the close.

The Curb followed the lead of the Exchange quite closely. The copper stocks were in demand at higher prices, but with some loss today. Nevada Consolidated was the leader in activity, but North Butte and Miami also sold largely. The Nevada gold stocks revived from their recent inactivity and sold largely. Cobalt stocks were also in demand at higher prices.

The Granby Consolidated Mining Company has declared a quarterly dividend of $2 per share, payable in December. The last dividend was paid in June.

The advertising of Utah Copper Company by Thomas W. Lawson indicates that

he is still in possession of an option on stock in that company, given to him by the Guggenheims, when arrangements were made for the marketing of the Yukon Gold Company.

Boston, Nov. 10—The market has been strong and active most of the the week, with advancing prices. Offerings of stocks were readily taken up. Yesterday there was a halt in the advance, and some taking of profits; but the market showed no loss in volume of transactions, and no marked recession in prices. The trading has continued broad. The market is making a good record. The five days from Wednesday to Monday, inclusive, show 666,010 shares dealt in, with Saturday's total of 116,428 shares in two hours, a record for this year. Copper stocks, while active, had an easier tendency today; price changes were not pronounced, the market holding steady in most cases. Dealings included over 4000 Utah Copper, 2000 Utah Consolidated, 4500 Amalgamated, 3500 Butte Coalition, and 4000 North Butte, with numerous other active specialties.

Copper Range sold off 50c. to $82, rallying to $82.50 again; Utah Copper lost $1, to $50.75; Utah Consolidated lost $1, to 44.25, but recovered to $45.75; Calumet & Arizona dropped $2, to $125, but recovered $1 of the loss.

Quincy's December dividend is $1 per share, which compares with $1 in September, and $2 a year ago.

STOCK QUOTATIONS

NEW YORK	Nov. 10	BOSTON	Nov. 10
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	5/8	Adventure	9½
Amalgamated	87¾	Allouez	41
Anaconda	52¾	Am. Zinc	25
Balaklala	‡2 1/16	Arcadian	4¾
British Col. Cop.	7⅞	Arizona Com	36¾
Butte & London		Atlantic	18½
Butte Coalition	28½	Bingham	‡.30
Colonial Silver	1½	Boston Con	17¾
Cum. Ely Mining	8⅞	Calumet & Ariz	126¾
Davis Daly	3¾	Calumet & Hecla	695
Dominion Cop	1	Centennial	35½
Douglas Copper	3¾	Con. Mercur	.40
El Rayo	4¾	Copper Range	82½
Florence	4¾	Daly-West	11
Foster Cobalt	.55	Franklin	15¾
Furnace Creek	.18	Greene—Can	12¾
Giroux	4⅝	Isle Royal	23⅞
Gold Hill	⅛	La Salle	15½
Goldfield Con	6¾	Mass	6¾
Granby	107	Michigan	15½
Greene Gold	3/8	Mohawk	71
Greene G. & S	9	Nevada	20
Greenw'r & D.Val.	‡.75	North Butte	88¼
Guanajuato	1⅜	Old Colony	.60
Guggen. Exp.	185	Old Dominion	57½
Hanapah	.15	Osceola	125
McKinley Dar.	1.20	Parrot	29
Micmac	3¼	Quincy	99
Mines Co. of Am.	1⅜	Rhode Island	5⅛
Mitchell Mining	3/8	Santa Fe	2¼
Mont. Sho.C	⅞	Shannon	18¾
Nev. Utah M. & S	3⅛	Superior	29
Newhouse M. & S	5½	Tamarack	87
Nipissing Mines	11	Trinity	19½
Old Hundred	1	United Cop., com.	16¾
Silver Queen	1.18	U. S. Oil	28
Stewart	1/16	U. S. Smg. & Ref.	43¾
Tennessee Cop'r.	44½	U.S.Sm. & Re.,pd.	46½
Tri-Bullion	1	Utah Con	45
Union Copper	7/16	Victoria	5¾
Utah Apex	6	Winona	7
Utah Copper	50¼	Wolverine	154
Yukon Gold	4⅜	Wyandotte	2½

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	30
Am. Smelt. & Ref.	97⅜
Am. Sm. & Ref., pf.	108
Bethlehem Steel	25⅝
Colo. Fuel & Iron	39¾
Federal M. & S., pf.	88
Inter. Salt	14¾
National Lead	85½
National Lead, pf.	105⅝
Pittsburg Coal	12¼
Republic I. & S.	27¾
Republic I. & S., pf.	97
Sloss-Sheffield	78¼
Standard Oil	630
U. S. Red. & Ref.	13¾
U. S. Steel	54¾
U. S. Steel, pf	112¾
Va. Car. Chem	38½

BOSTON CURB	
Ahmeek	‡120
Black Mt.	4
East Butte	8
Hancock Con.	10⅛
Keweenaw	6⅞
Majestic	.74
Raven	.99
Shawmut	.10
Superior & Pitts.	‡14
Troy Man	‡.25

ST. LOUIS	Oct. 31	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie.	.04	.03
Center Cr'k	1.80	1.50
Cent. C. & C.	66.00	65.00
C.C. & C. pd.	76.00	74.00
Cent. Oil.	110.00	100.00
Columbia	6.00	4.00
Con. Coal	21.00	19.00
Doe Run	125.00	110.00
Gra. Bimet.	.30	.25
St. Joe.	15.00	12.50

LONDON	Nov. 11		
Name of Com.	Clg.		
Dolores	£1	10s	0d
Stratton'sInd.	0	1	3
Camp Bird	0	15	9
Esperanza	3	3	9
Tomboy	1	1	3
El Oro	1	5	0
Oroville	0	8	9

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Nov. 11.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.14
Belcher	.27	St. Ives	.24
Best & Belcher	.47	Triangle	.04
Caledonia	.17	BULLFROG STOCKS	
Challar	.16	Bullfrog Mining	‡.03
Comstock	‡.24	Bullfrog Nat. B.	‡.04
Con. Cal. & Va.	.61	Gibraltar	.03
Crown Point	.25	Gold Bar	‡.03
Exchequer	.35	Homestake King.	.14
Gould & Curry	.17	Montgomery Mt.	‡.05
Hale & Norcross	.43	Mont. Shoshone C.	.87½
Mexican	.73	Original Bullfrog.	‡.01
Ophir	1.87	Tramp Cons	.15
Overman	.13	MANHAT'N STOCKS	
Potosi	.16	Manhattan Cons.	‡.05
Savage	.42	Manhat'n Dexter.	‡.03
Sierra Nevada	.34	Jumping Jack	‡.03
Union	.29	Stray Dog	‡.03
Utah	.04	MISCELLANEOUS	
Yellow Jacket	.52	Golden Boulder	‡.05
TONOPAH STOCKS		Bonnie Clare	.08
Belmont	1.15	Lee Gold Grotto	...
Extension	.59	Nevada Hills	1.50
Golden Anchor	.01½	Nevada Smelting.	.87½
Jim Butler	.23	Pittsburgh S. Pk.	.97
MacNamara	.55	Round Mt. Sphinx	.18
Midway	.29		
Montana	.78		
North Star	.06		
Tono'h Mine of N.	7.00		
West End Con	.51		
GOLDFI'D STOCKS			
Adams	.04		
Atlanta	.24		
Booth	.35		
Columbia Mt.	.20		
Comb. Frac.	1.34		
Cracker Jack	.05		
Dia'dfield B. B. C.	.14		
Goldfield Belmont	.05		
Goldfield Daisy	.97		
Great Bend	.35		
Jumbo Extension	.31		
Katherine	...		
Kendall	.14		
Lone Star	.08		
May Queen	.06		
Oro	.14		
Red Hill	.23		
Roanoke	...		
Sandstorm	.24		

COLO. SPRINGS	Nov. 7
Name of Comp.	Clg.
Acacia	6¼
Black Bell	...
C. C. Con	‡3½
Dante	6¼
Doctor Jack Pot	7
Elkton	65½
El Paso	48¾
Findlay	‡19½
Gold Dollar	8
Gold Sovereign	3½
Isabella	26⅞
Index	...
Jennie Sample	2¾
Jerry Johnson	‡3⅞
Mary McKinney	28
Pharmacist	‡3⅝
Portland	1.02
Un. Gold Mines	4
Vindicator	82
Work	8½

Assessments

Company.	Delinq.	Sale.	Amt.
Amador, Ida	Nov. 20	Dec. 19	$0.02
American Fork, Utah	Oct. 28	Nov. 25	0.01
Cedar, Utah	Nov. 20	Dec. 10	0.03
Columbus Ext., Utah	Nov. 13	Nov. 25	0.01
Con. Cal. & Va., Nev	Nov. 24	Dec. 15	0.20
Crown Point, Nev.	Nov. 17	Dec. 8	0.10
Ely Con., Nev	Nov. 28	Jan. 11	0.02
Gould, Mont	Nov. 7	Dec. 7	0.05
Imlay, Utah	Nov. 11	Nov. 28	0.01
Liberty, Utah	Nov. 5	Dec. 2	0.03
Lucky Dutchman, Nev.	Nov. 21	Dec. 12	0.01
Mexican, Nev	Nov. 12	Dec. 3	0.10
Mountain Monarch, Cal.	Oct. 24	Nov. 24	0.05
N. Y. Bonanza, Utah	Nov. 5	Nov. 25	0.02
Overman, Nev	Dec. 2	Dec. 23	0.05
Penn. Con., Cal.	Nov. 2	Nov. 25	0.10
Seg. Belcher & Mides, Nev.	Nov. 7	Nov. 28	0.03
Silver King Con., Utah	Nov. 4	Nov. 25	0.05
Utah-United, Utah	Nov. 10	Nov. 27	0.01
Wabash, Utah	Nov. 10	Dec. 3	0.08
Washakie-Nev., Utah	Nov. 27	Dec. 18	0.01

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	52.795	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	53.115	31.366	24.514
August	68.745	51.683	31.637	23.858
September	67.792	51.720	31.313	23.877
October	62.435	51.431	28.863	23.725
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.598	25.072	12.788	102.375	57.387
June	21.665	12.675	24.140	12.877	97.272	57.842
July	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.255	13.639	79.679	60.500
September	15.565	13.388	16.047	13.600	68.375	60.338
October	13.169	13.354	13.551	13.646	60.717	60.139
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	...

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.667	29.942
March	41.313	30.577	September	36.689	28.815
April	40.938	31.702	October	32.620	29.444
May	42.149	30.015	November	30.833	.....
June	42.120	28.024	December	27.925	.....
			Av. year.	38.160	....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.700	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.580	19.063	13.375
September	4.813	4.515	19.775	13.125
October	4.750	4.351	18.531	13.375
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26 094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.